plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

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A HALF CENTURY OF SERVICE TO ELECTROPLATING METAL FINISHING AND ALLIED ARTS
GOLDEN JUBILEE 1959

University Microfilms
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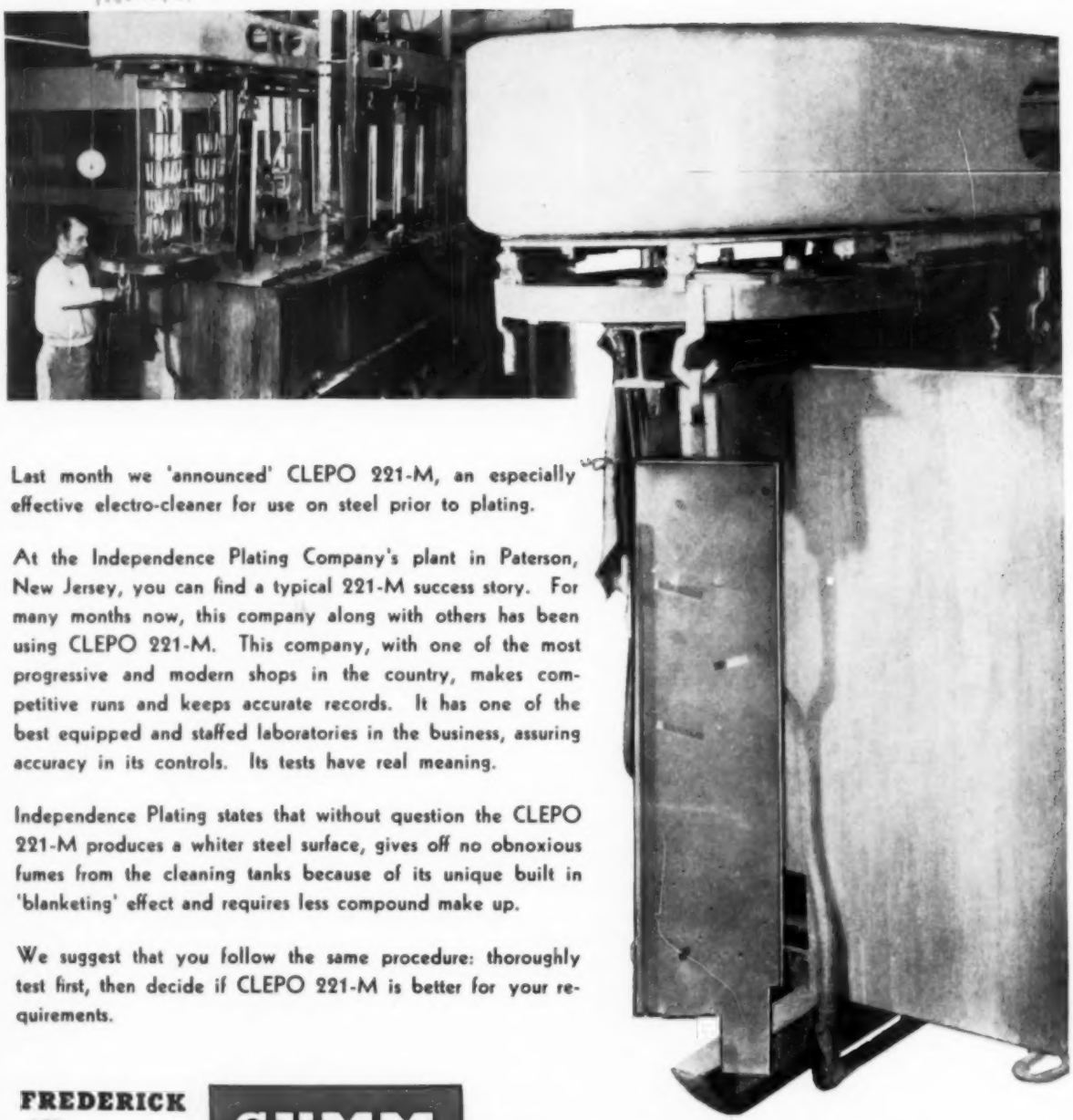
Ann Arbor, Michigan

FEBRUARY 1959

A Typical *Success Story* for CLEPO 221-M



Last month we 'announced' CLEPO 221-M, an especially effective electro-cleaner for use on steel prior to plating.

At the Independence Plating Company's plant in Paterson, New Jersey, you can find a typical 221-M success story. For many months now, this company along with others has been using CLEPO 221-M. This company, with one of the most progressive and modern shops in the country, makes competitive runs and keeps accurate records. It has one of the best equipped and staffed laboratories in the business, assuring accuracy in its controls. Its tests have real meaning.

Independence Plating states that without question the CLEPO 221-M produces a whiter steel surface, gives off no obnoxious fumes from the cleaning tanks because of its unique built in 'blanketing' effect and requires less compound make up.

We suggest that you follow the same procedure: thoroughly test first, then decide if CLEPO 221-M is better for your requirements.

FREDERICK
2-FG2

GUMM *Chemical Company Inc.*

538 FOREST STREET, KEARNY, N. J.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 200.

INDICATE A 201. ➔

How to make rust-and-scale removal an exact science: For more than 20 years, Enthone has studied metal finishing problems and developed specialized solutions. Among the rust and scale removal compounds perfected by Enthone research and proved in the field, are the Alka-Deox® series of alkaline materials which electrolytically or non-electrolytically remove rust and scale from steel, cast or malleable iron; Enthol® 42, a solvent acid cleaner for steel, zinc, aluminum and other metals; and Actane® 70, a replacement for hydrofluoric acid as a dispersing agent in acid pickles to remove colloidal and siliceous films from metals. Write us about your special oxide removal problems. Chances are we have the answer in stock. Enthone, Inc., 442 Elm Street, New Haven 11, Connecticut.

ENTHONE

ENTHONE, INC. IS A SUBSIDIARY OF AMERICAN SMELTING AND REFINING COMPANY

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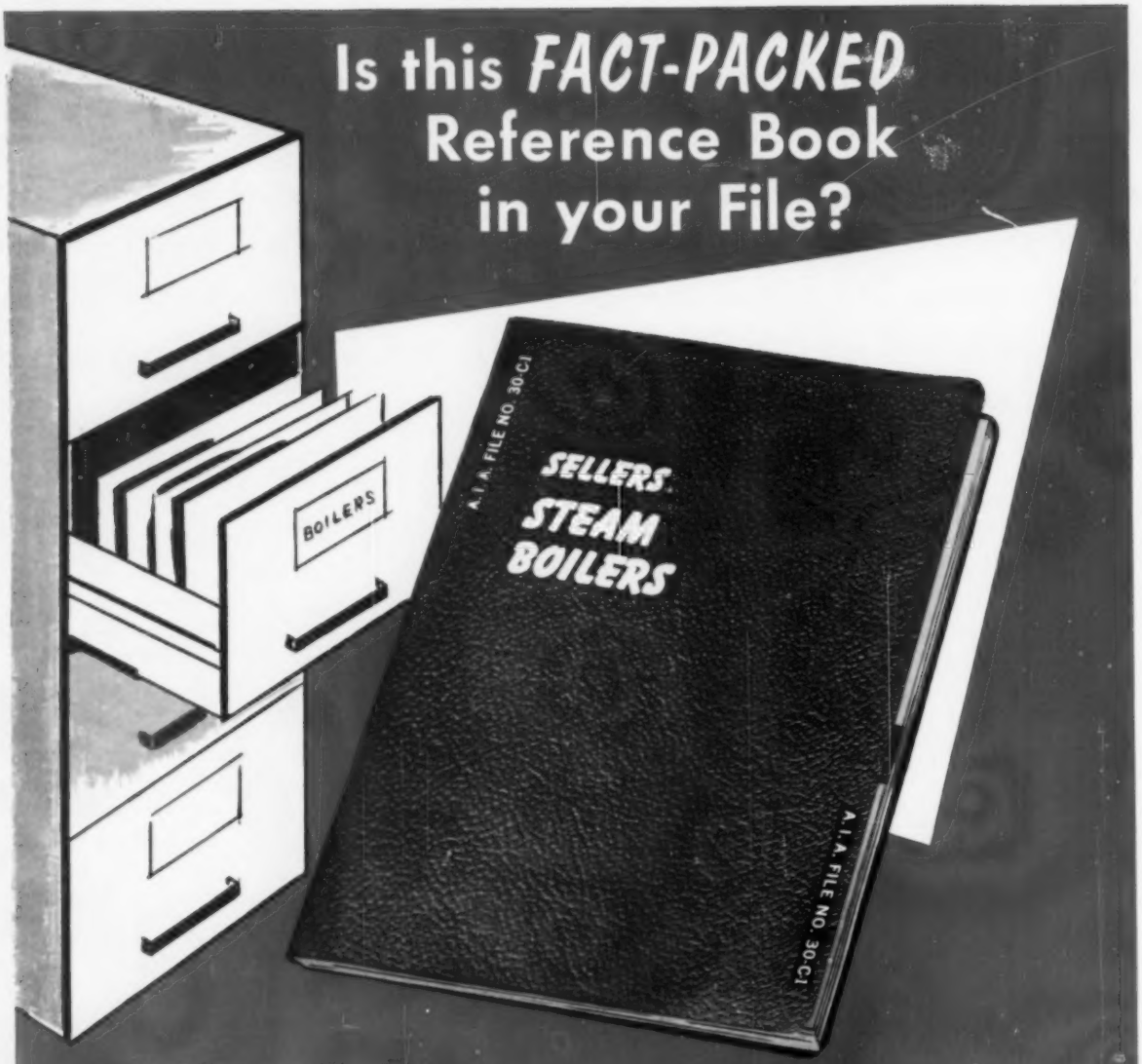

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- Overcoming Building Vacuum and Chimney Back Draft
- Easy Accessibility
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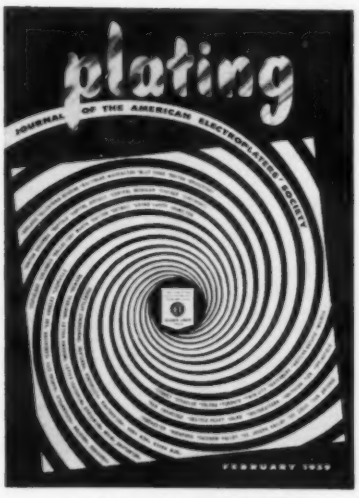

Cover Designed by James A. Civille.

plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

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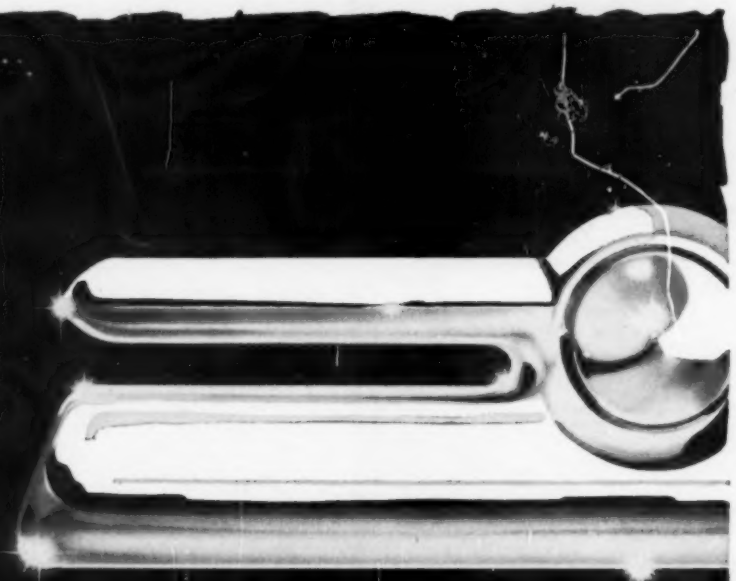
UNMATCHED CORROSION RESISTANCE



The No. 1 Feature of

HARSHAW PERFLOW PERGLOW DUPLEX *Nickel Plating Process*

Harshaw's research and development laboratory solved the problem of plating nickel on nickel. This, coupled with the use of a sulfur-free nickel plate and a bright nickel from a compatible bath, has made possible a Duplex deposit with unequalled corrosion resistance.

EXCELLENT CORROSION PROTECTION ACHIEVED THROUGH USE OF A SULFUR-FREE DEPOSIT

The Harshaw Chemical Company after years of research and development work was the first to find that a *sulfur-free* nickel offers greater corrosion resistance. This fact led to the development of the Harshaw Perflow nickel plating process. Further research showed that use of the sulfur-free Perflow nickel deposit as a base coating, followed by a bright nickel deposit from a *compatible* bath, would give a Duplex deposit with a further improvement of corrosion resistance. Performance data, by both accelerated tests and outdoor exposure, from leading automobile manufacturers and parts suppliers indicate that the Harshaw Perflow-Perglow Duplex nickel plate is comparable to and frequently better than, buffed gray nickel and is unequalled by any bright nickel.

MANY OTHER ADVANTAGES

1. Exceptionally high plating speeds —with air or mechanical agitation.
2. Excellent Chrome Coverage.
3. Unsurpassed Leveling Characteristics.
4. Outstanding Brightness.
5. High Tolerance to Impurities.
6. Excellent Adhesion.
7. Excellent Ductility at Full Brightness.
8. Simplified Control — Stable over extended periods of operation.
9. Controlled Stress.
10. Uniform Protective and Decorative plate on both steel and zinc die castings.

THE HARSHAW CHEMICAL CO.

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Chicago • Cincinnati • Cleveland • Detroit • Houston
Los Angeles • Hastings-On-Hudson • Philadelphia • Pittsburgh

HARSHAW

EDITORIAL

A HYPOTHETICAL DAY

A PLATER awoke on a bright, sunny day,
Feeling elated and happy and gay;
To his business he went with a heart full of joy,
With a step just as light as a ten-year old boy.

The boss came to him and he said with a smile,
"I have good news to tell you, just listen awhile.
All this nickel plating you turn out, my son,
Is the best nickel plating that ever was done.
Our customers say that our goods never rust,
And that work plated here they can certainly trust,
If it stays in the weather all day and all night,
For a year and a half, why that plating stays bright."

A polisher stopped him, and said without smirk,
"This shop is surely a good place to work.
Those castings we're getting are certainly nifty,
You can rough them right out on a hundred and fifty.
And the glue that we're using, we surely can praise,
When I set up a wheel, it now lasts some eight days."

Then one of the buffers stepped up, and said he,
"Those buffs are the best that I ever did see.
Every section is balanced, I think that's essential,
They run just as smooth as a car's differential.
And the plating turned out, it is certainly slick,
It is easily buffed, though the nickel is thick.
Those plating room helpers, they really have learned,
And we now get out work that seldom is burned."

His plating assistant came to him and said,
"Those tanks work so fast, they can hardly be fed.
The solutions plate fine, they meet all speed limits,
Work that spanned hours now lasts only minutes."

No doubt you are wondering if all this is true,
And if all of these good things can happen to you.
Yes, one of the reasons for this man's success,
Is because he courts knowledge through growing AES.

For knowledge that's buried and hidden from sight,
Can be of great value when brought to the light.
That the Golden Rule profits, I firmly believe,
In the Society you'll harvest to the extent that you give.

(Reprinted, with some revisions as a GOLDEN JUBILEE item of past but lingering interest, from the March 1916 issue of MONTHLY REVIEW, forerunner of PLATING MAGAZINE)

*YOU GET THE NICKEL CONTENT YOU PAY FOR in Nuodex Nickel Sulphate and Nickel Chloride

Nuodex was the first and is still the only manufacturer to certify the metal content of metallic salts. This means that in your plating operations you are sure of the metal content and can calculate your needs and costs accurately.

Nuodex Nickel Sulphate is high in purity, free flowing and completely soluble—insuring consistent performance.

Nuodex Nickel Chloride also benefits the user by its certified uniformity and its ease in handling from the special package.

All the Nuodex Metallic Salts are certified as to metal content. Inquire about Nuodex Nickel Formate, Nickel Carbonate, Nickel Nitrate, Cobalt Sulphate and other metallic salts. Remember, Nuodex is your continuous source of supply.

NUODEX special purpose chemicals for industry

Fungicides • Nickel Salts • Organic Peroxides • Paint Additives • Stearates • Vinyl Additives

NUODEX PRODUCTS COMPANY • ELIZABETH, NEW JERSEY

A Division of Heyden Newport Chemical Corporation

GOLDEN JUBILEE ISSUE ADVERTISING RESERVATION

THE Fiftieth Anniversary observance of the American Electroplaters' Society, Inc. (AES) will be climaxed not only by the AES's Golden Jubilee Convention and Industrial Finishing Exposition, including the Fifth International Conference on Electrodeposition and Metal Finishing, to be held in Detroit, June 15-19, 1959 but also by the GOLDEN JUBILEE ISSUE of AES's PLATING MAGAZINE (June 1959).

A FEATURE edition beamed to command global readership appeal by the character of its special technical and scientific articles, it will also have rare remembrance strength and long retainment as an AES reference source and memento of AES's GOLDEN ANNIVERSARY by the character of its institutional and historical contents, including the "Kaleidoscope of AES's First Half-Century."

BECAUSE of the GOLDEN JUBILEE ISSUE's planned sizable editorial stature, PLATING's blueprint of that issue, at this stage, allows for only 150 pages of company product and institutional advertising, much of which has already been spoken for by PLATING MAGAZINE's regular contract advertisers. There is no price increase for advertising in that issue. PLATING's current space rates (Rate Card No. 9), lowest among magazines in this field for largest paid circulation apply to wit on a one-time basis:

1 page	$270	1/2 page	$155
2/3 page	250	1/3 page	150
1/2 page (Is)	220	1/4 page	80
		1/8 page	$60

Extra charge for color and/or bleed.

Available special positions are charged extra.

ALL text and plates for advertising accepted and contracted to appear in the GOLDEN JUBILEE ISSUE must be in the hands of PLATING's Production Manager on or before April 15, 1959.

IF YOU are among the many companies interested in reaching the vast purchasing power of the electroplating and metal finishing industry through product or institutional advertisement(s) in this unique feature edition, you are earnestly invited and urged to fill out the below advertising reservation ticket, and mail it NOW to Golden Jubilee Issue Section, PLATING MAGAZINE, 443-445 Broad Street, Newark 2, N. J.

GOLDEN JUBILEE ISSUE ADVERTISING RESERVATION

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Reserve for ..... (Specify Company)

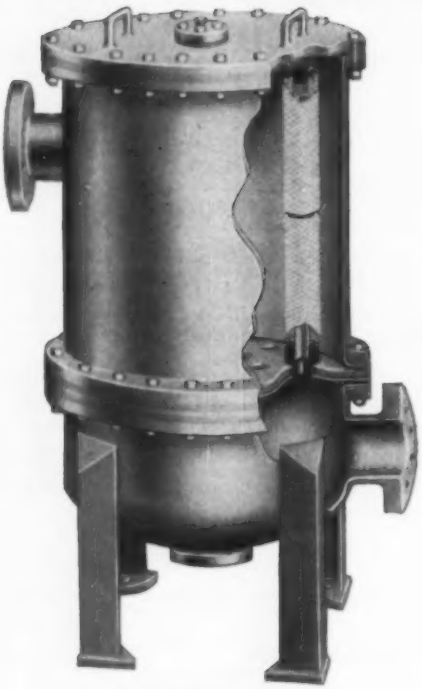
a total of ..... (Specify amount of space) in the GOLDEN JUBILEE ISSUE and communicate by phone or letter with the undersigned so as to finalize insertion details.

..... (Company or Agency)

By ..... (Title)

F-1

TANK TURNOVER 3 *times per hour* MEANS BETTER PLATING QUALITY



Fulflo Filters

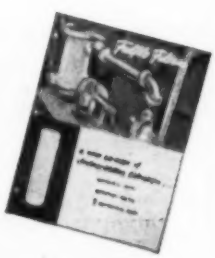
This rubber-lined steel model is available with 1 to 124 Honeycomb Filter Tubes for acid solutions for small tanks — capacities as high as 3000 gallons.

By removing microscopic solid impurities as fast as they're formed, you get a hard firm plate without costly rejects. Fulflo Filters provide tank turnover up to three times per hour. This means *complete solution filtration* up to four times in an eight-hour day.

Best of all, you get these advantages in a compact, low-cost filter with long-lasting elements that require no maintenance. Fulflo Filters take as little as 3 square feet of floor space. Honeycomb Filter Tubes last from 6 to 12 weeks and can be replaced in just a few minutes. There's no costly downtime — no cakes, plates, screens, bags, papers or filter aids.

In addition to the rubberlined steel model (illustrated) you have a wide choice of stainless steel Fulflo Filters for high *p*H solutions; plain steel for cyanide solutions.

To assure better plating quality, investigate Fulflo Filters. Write for "A New Concept of Plating Filtration" to Dep't PL



COMMERCIAL FILTERS CORPORATION
MELROSE 76, MASSACHUSETTS
PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

MICRO-CLARITY AT MINIMUM COST

Fulflo Filters — *with genuine Honeycomb Filter Tubes for controlled micro-clarity of industrial fluids.*

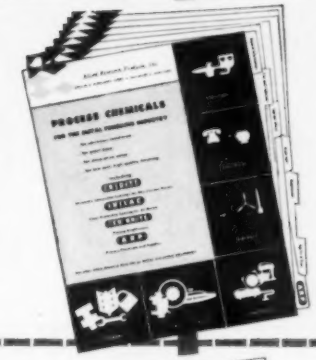
CFC Filters — *Selective filtration of oils • water-oil separators • magnetic separators • pre-coat filters • coolant clarifiers • automatic tubular conveyors.*

FREE DATA FILES
on
Allied Research LINES

LOOK FOR THE DIAMONDS—SIGN OF FINISHING QUALITY

METAL FINISHING PROCESSES

A complete line of quality products and processes developed primarily as a result of helping manufacturers like yourself solve their metal finishing problems. If one of our present products does not meet your needs, we'll be glad to work with you to find an answer to your problem.



IRIDITE® Chromate Conversion Coatings for Non-Ferrous Metals.

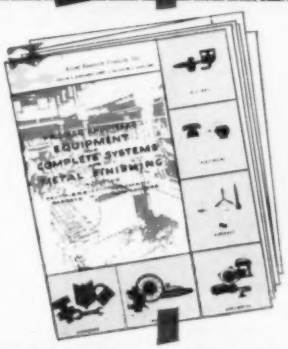
IRILAC™ Clear Protective Coatings for All Metals.

ISOBRITE® *Chemically Different* Plating Brighteners.

ARP® *Process chemicals.*

EQUIPMENT AND COMPLETE SYSTEMS
for Metal Finishing

Process Engineered—Single pieces of equipment or all equipment necessary for a finishing operation—evaluated, designed, fabricated, installed and tested to match exactly your particular process. Ask about our *Process Engineering Service.*



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Silicon and Selenium, built to exacting specifications for long life, trouble-free service.

WAGNER AUTO-LOADERS

for fast, economical transfer of racks and parts, conveyors to plating machines, between conveyors.

AUTOMATIC AND SEMI-AUTOMATIC PLATING MACHINES

BARRELS, TANKS and other equipment.

CHEMICALS AND SUPPLIES

Prompt service on a wide variety of daily-use necessities for the plating room, delivered from warehouse stocks strategically located in cities in metalworking areas.

FLAT-TOP® **ANODES** in copper and zinc.

LECTROCOP® **FLAT COPPER ANODES**

CADMIUM, WHITE BRASS AND TIN ANODES in most efficient shapes. Acid Replacements, Buffs, Chemicals, Cleaners, Maintenance Materials.

NICKEL RECASTING SERVICE

Ask your Allied Field Engineer about our Subscription Plan which combines your new nickel purchases with a service to recast *your* butts and spears, resulting in substantial savings.

Allied Research Products, Inc.
4004-06 EAST MONUMENT STREET
BALTIMORE 5, MARYLAND
Branch Office: 400 Midland Avenue, Detroit 3, Michigan
Chemical and Electrochemical Processes, Anodes, Rectifiers, Equipment and Supplies for Metal Finishing.

WRITE TODAY FOR COPIES of these useful files describing technical details of our complete line, OR, phone your Allied Field Engineer. He's listed under "Plating Supplies" in your 'phone book.

Narda SonBlasters offer the most complete line of lowest-cost mass-produced ultrasonic cleaners!

Narda's mass-production techniques assure you the most complete line of ultrasonic cleaners at the lowest prices in the industry! From the smallest 35-watt to the amazing 2500-watt unit with a tank capacity of 75 gallons, Narda's SonBlasters are available **now**—off-the-shelf—for immediate delivery. And with a full 2-year warranty besides!

Proper cleaning is essential to perfect plating. Tarnish, corrosion, oxidation, grease and oil deposits, and other foreign matter are removed quickly and thoroughly with a Narda SonBlaster. Regardless of the configuration, intricacy or presence of minute crevices, the power of Narda ultrasonic cleaning will help you prepare for plating, faster, better and cheaper!

No matter what you need in ultrasonic cleaning equipment, you'll find Narda's complete line of production-size units have the quality, power, performance, capacity and appearance of cleaners selling up to three times their price! Write for more details **now** and we'll include a free questionnaire to help determine the precise model you need. Address: Dept. PL-35.

Generator G-202 **Transducerized Tank NT-202**
35 watts **Capacity: ⅜ gallon**

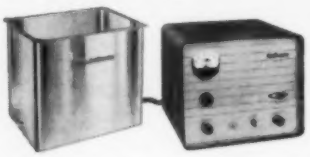
An amazingly efficient, yet inexpensive, ultrasonic cleaner. Duty cycle timer permits operator to turn the unit on, set it, and leave; the SonBlaster will turn off automatically at the end of the cycle. Four choices of timers—from 0-15 min. to 0-120 min. Also available without timer at slightly lower cost (G-201).

$220

Generator G-601 **Transducerized Tank NT-602**
60 watts **Capacity: 1 gallon**

A more powerful production-type unit, with a special circuit and selector switch permitting operator to alternate between two tanks, when items being cleaned require different solutions or a two-step process.

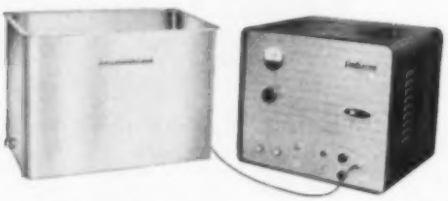
$350



Transducerized Tank NT-1505 **Generator G-1501**
Capacity: 5 gallons **200 watts**

The lowest price in the industry for a tank of this capacity and activity. Generator also will operate 2, 3 or 4 submersible transducers at one time, with just a turn of the load selector switch on the front panel.

$695



Transducerized Tank NT-5001 **Generator G-5001**
Capacity: 10 gallons **500 watts**

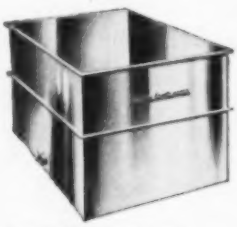
Generator features standby switch for longer life and load selector switch on the front panel to operate up to 8 submersible transducers or 8 NT-602 or 2 NT-1505 transducerized tanks at one time. Larger tanks available on special order.

$1325

Submersible Transducer NT-605

Heli arc welded stainless case, hermetically sealed for safe, leak-proof immersion. Radiating face: 27 sq. in. Effective plane of radiation: 40-50 sq. in. (approximately 10" x 5"). Effective cavitation of volumes up to 1200 cu. in. at 24 in. tank height (5 gal.) and 2400 cu. in. at 48 in. tank height (10 gal.). Bulkhead electrical fitting on back allows all wiring connections to be made on outside of tank. For use in any arrangement or location in any shape tank you desire to use. Also available—model NT-604, identical with NT-605, except for pipe thread instead of bulkhead fitting, permitting electrical connections inside of tank.

$130

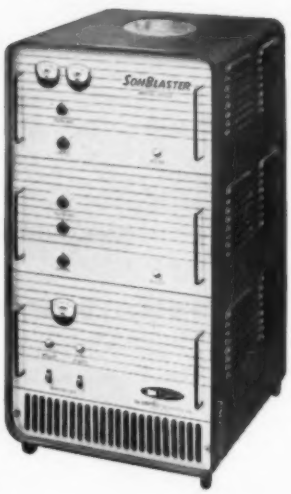


Transducerized Tank
NT-25001
Capacity: 75 gallons

Powerful unit drives the largest mass-produced industrial-size transducerized ultrasonic cleaning tank made! Also energizes up to 40 Narda 60-watt submersible transducers (NT-604 or -605). Capable of energizing tanks measuring up to 150 square feet of area by 2′ or 3′ high.

$4360

Generator G-25001
2500 watts



Consult with Narda for all your ultrasonic requirements. The SonBlaster catalog line of ultrasonic cleaning equipment ranges from 35 watts to 2.5 KW, and includes transducerized tanks as well as immersible transducers which can be adapted to any size or shape tank you may now be using. If ultrasonics can be applied to help improve your process, Narda will recommend the finest, most dependable equipment available—and at the lowest price in the industry!

For custom-designed cleaning systems, write to our Industrial Process Division; for information on Chemical processing applications, write to our Chemical and Physical Process Division; both at the address below.

the narda ultrasonics corporation
625 MAIN STREET, WESTBURY, L. I., N. Y.
Subsidiary of The Narda Microwave Corporation

Project Alert Working at UDYLITE *Produces for You...*

SILICON EFFICIENCY, RUGGEDNESS AND LONG LIFE

for old rectifiers

1. **A SPECIAL PRODUCT . . .** For the first time, a Udylite-engineered, Udylite-built *silicon* replacement stack is offered for you to use in revitalizing your Udylite magnesium-copper-sulphide or selenium rectifier and upgrading its performance to the level of today's best. *And you can do this in your own shop,* without delay, at a minimum of expense and down time.
2. **A SPECIAL SERVICE . . .** As an alternate plan, your old rectifier can be returned to Udylite for *factory* installation of the silicon replacement stacks by trained rectifier specialists. At the same time, your rectifier will be completely overhauled and tested so that it will be returned to you renewed and ready for the longer life and high efficiency of Udylite silicon.
3. **A SPECIAL VALUE . . .** This whole program is set up as a Project Alert. A special department will handle your order and your equipment from start to a completely satisfactory finish. A *guaranteed delivery* will keep your down time to a minimum. With prices based on a production line plan, you will get more value per dollar spent than you ever before thought possible.

Let Udylite help you get your entire plating operation in top working order and ready to go at peak capacity. Your Udylite sales engineer will be calling on you soon. But if you need priority service, write, phone or wire directly to:

the udylite corporation

detroit 11, michigan • world's largest plating supplier

PROJECT ALERT

Here's an aluminum ...reduces maintenance costs... ...MIL-

Ordinary caustic solution causes build-up of scale on tank interior. Scale must be chipped off frequently.

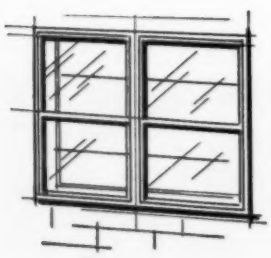
New Wyandotte Mil-Etch suspends dissolved aluminum in solution. No scale develops throughout entire life cycle.

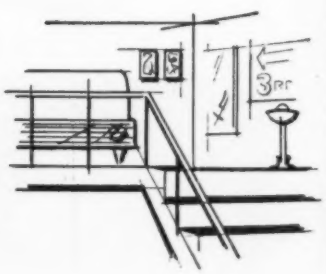
Here's a brand-new caustic-type aluminum etchant that eliminates expensive shutdowns, needless maintenance and labor costs. Mil-Etch keeps dissolved aluminum in solution—prevents it from forming a hard scale that must be chipped from tank walls.

Etches rapidly and uniformly. Economically concentrated, Wyandotte Mil-Etch produces an attractive, uniform, high-quality etch in only a few minutes on aluminum extrusions, wrought sheets and bar stock. You can also use Mil-Etch for deep etching or chemical milling of aluminum alloys.

Easy to use. Mil-Etch is nondusty, will not cake

Use Mil-Etch for





etchant that eliminates scale produces a bright matte surface

ETCH !

in drums; also, no excessive foam or fumes. You can use a tank of Mil-Etch until it becomes "loaded" with dissolved aluminum. Tank dumping is simple – just pull the plug!

Desmutting. For brightening aluminum alloys that turn dark in alkaline etching processes, try Wyandotte 2487. It is safer than ordinary acid solutions, and permits a closer control of the desmutting bath. Being in easy-to-handle granular form, solution make-up and additions are simple.

For full information on how new Mil-Etch and Wyandotte 2487 will solve your aluminum-etching problems, call your Wyandotte representative.

Wyandotte Chemicals Corporation, Wyandotte, Mich.
Also Los Nietos, Calif. Offices in principal cities.

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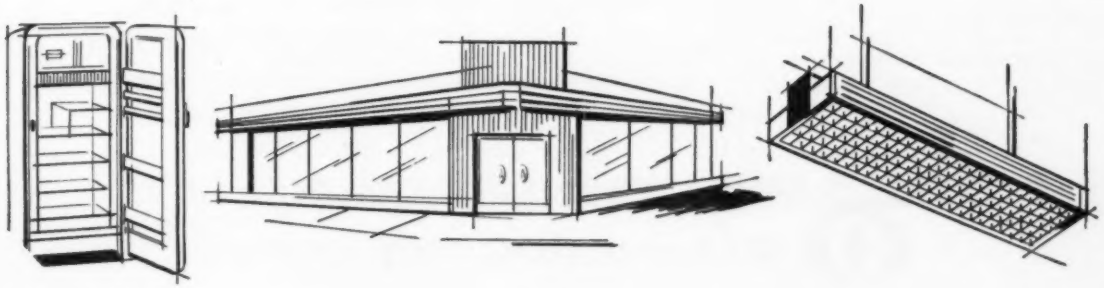


Quality

chrome plating is our goal for you!

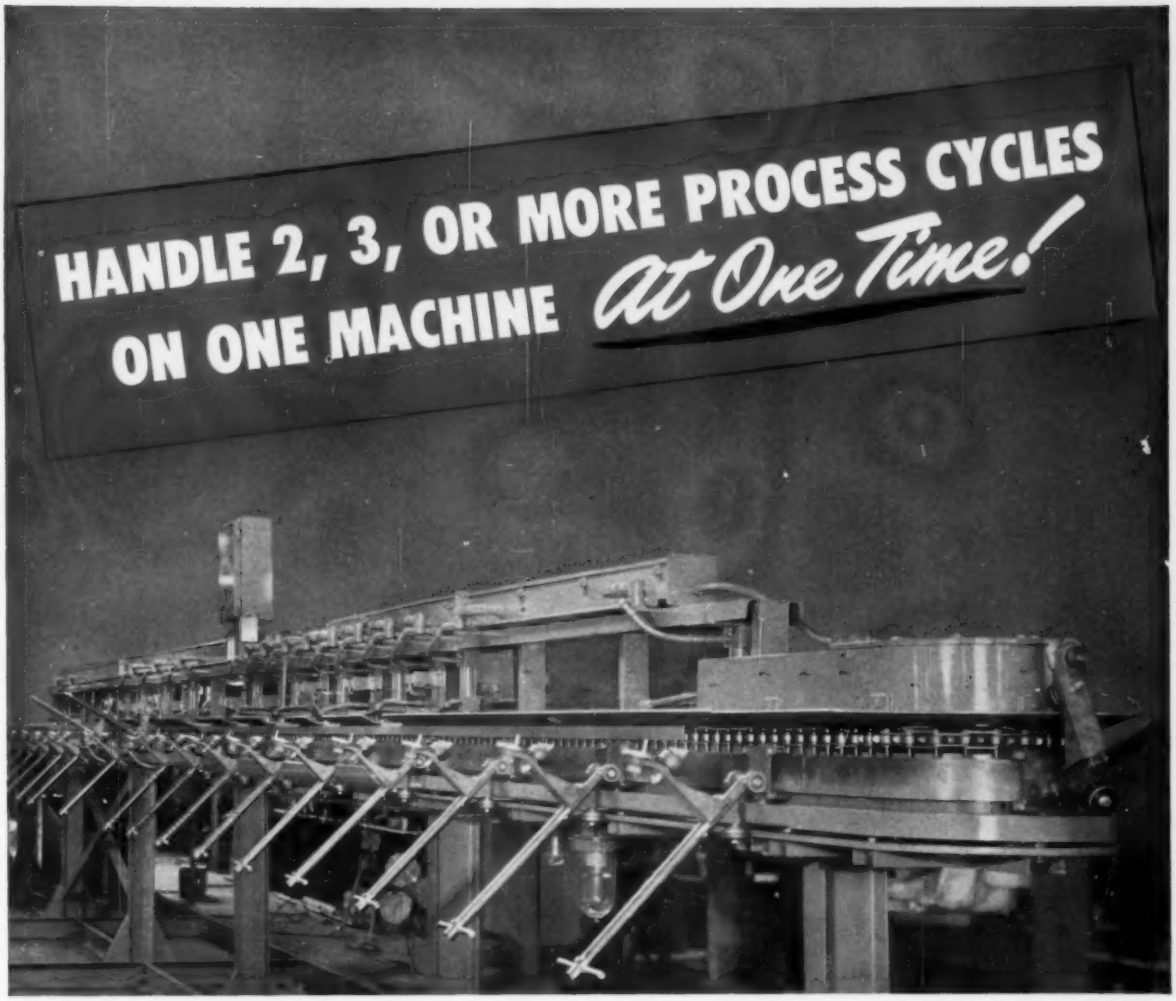
Here, at Diamond, our plating specialists strive constantly to raise the standards of chrome plating.

For example, they developed DIAMOND CPA 1800 for you. It is *the additive* for chrome plating which increases plating speed, expands tank capacity, improves throwing power and the metallurgical character of chromium plate.

And, when you specify and use DIAMOND CHROMIC ACID, you get the latest facts on all phases of chromic acid application, research, testing. Facts that can help you lick a production problem, quality problem, or research problem.

For top-quality plating get DIAMOND CHROMIC ACID and DIAMOND CPA 1800 *plus* all the facts from your Diamond Representative or your nearby Diamond Distributor. They can be mighty helpful . . . they can supply DIAMOND CHROMIC ACID where and when you need it. Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.

Diamond Chemicals



LASALCO'S *Select-O-Matic*

MULTIPLE PROCESS PLATER

Another Lasalco development that offers the industry the last word in *fully automatic* plating!

With the new Select-O-Matic, the operator simply selects the desired process cycle for individual racks, when loading the machine, merely by turning a dial on the carrier. From that point, the rack *automatically* travels through the entire selected cycle without further attention.

A single Select-O-Matic plater, manned by one operator, will handle several various processes simultaneously. Different machines for each process are eliminated—original investment in equipment is greatly reduced—much less floor space is needed—maintenance is cut to an absolute minimum.

The Select-O-Matic is easily adaptable to any operation. Tell Lasalco about *your* operation and requirements to learn what this new machine can do for *your* production and profits.

Write Today!

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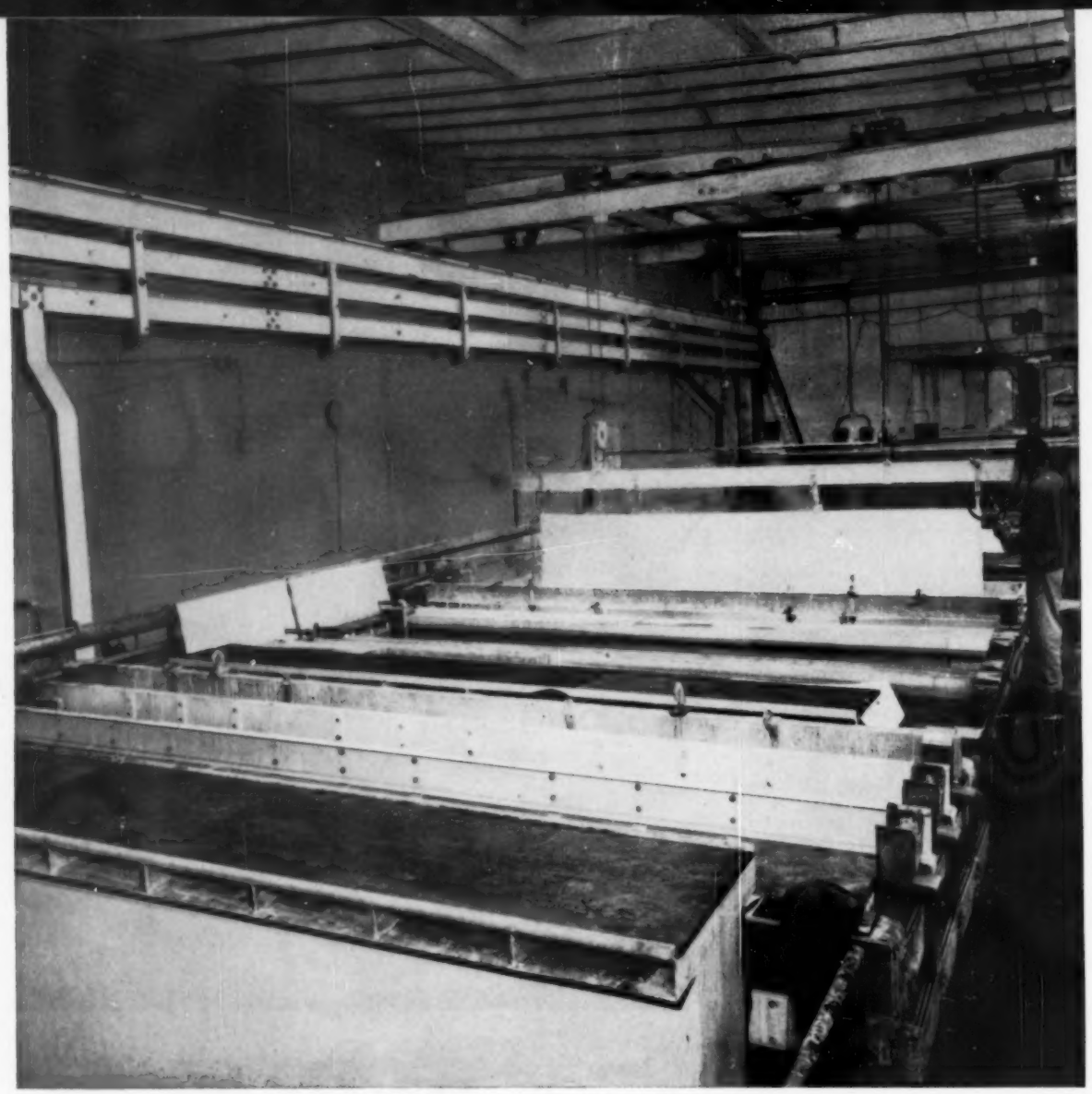

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LUSTRIK SAVES $673 WITH ALCOA ALUMINUM BUS CONDUCTOR

Specify Alcoa® Aluminum Bus and you'll realize substantial savings in both initial material costs and in over-all installation costs. For example . . .

By modernizing its Philadelphia plant with new Alcoa Aluminum Bus Conductor, Lustrik, Inc., saved $673 in material costs alone. Additional savings resulted from easier, faster installation and lighter, less expensive bus supporting structures.

Low material and low installation costs, plus easy-to-make connections, are strong reasons to use Alcoa Aluminum Bus Conductor. Immediate delivery of rectangular shapes in popular sizes is available from Alcoa or your Alcoa Distributor. Write for a copy of *Alcoa Aluminum Bus Conductor Handbook;* it thoroughly covers the design and use of aluminum bus conductor. Aluminum Company of America, 2115-B Alcoa Building, Pittsburgh 19, Pa.

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A Timely Message on Simplicity in thinking . . . a neglected ingredient?

by Ben P. Sax

Chairman of the Board, *American Buff Company*

Today's familiar electronic brains, computers, and automated production methods lead many young people to regard all worthwhile creative effort as the product only of complex and super-specialized intricate ideas. Such an attitude may foster costly neglect of simple, basic principles and their creative adaptations.

Yet "switcharoos" of basically simple ideas or simple basic principles have produced mechanical and production methods as startling in their field as many electronic successes. This point is easily illustrated by the outstanding improvements in farm building construction achieved by a self-taught engineer with a background of boyhood adaptation of familiar ideas to unfamiliar uses.

> His latest effort . . . corrugated metal panels for building frameless grain elevators, supermarts, churches, and many other large structures. By folding a piece of paper in an unusual pyramidal, double corrugation, he proved that the thin sheet stood by itself without buckling while supporting heavy weight. Use of this simple principle has cut the construction cost of a supermarket about 50%.

Let us all encourage the nation's youth to treasure and use, not neglect, simplicity . . . a vital element in every phase of life.

Sincerely,

Ben P. Sax

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Pat. No. 2,582,506

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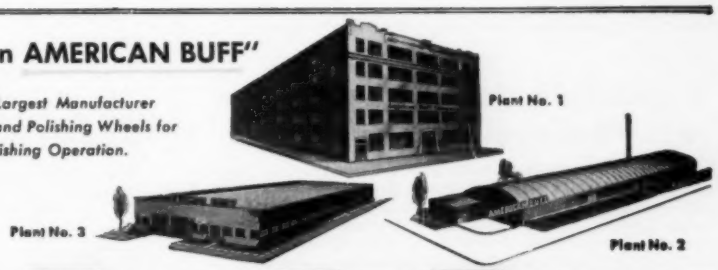

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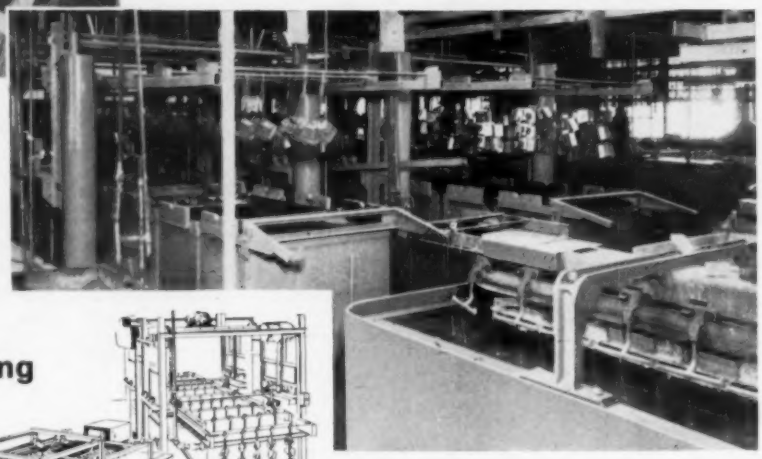
BELKE Automatic Pre-plate processing

cuts costs so much that few job platers can compete with others unless they have it.

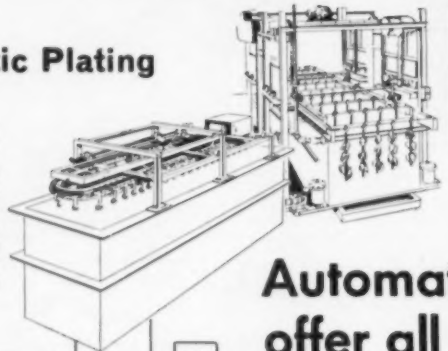


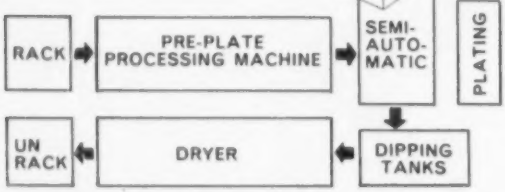
Above—Loading end of automatic processing machine. Plating racks loaded with work are hooked to removable rods. The machine advances each rod automatically from tank to tank at precisely timed intervals.

At Right—Unloading end of automatic processing machine. The racks of processed work are transferred to semi-automatics or still plating tanks.

Flexible Automatic Plating at LOW COST

For big production of high quality plating with varied work many plants use arrangements like this: 1) The automatic processing machine, 2) A combination of semi-automatics and still plating tanks as required by the variations in their work, 3) Dipping tanks, and 4) dryers suitable for drying racked work (Fig. 1)





Installations like the above afford complete cleaning, plating and drying from start to finish with one racking—Flexibility is retained as needed. Handling is minimized, walking is eliminated. Cost reduction is tremendous.

Typical pre-plate cycles with the BELKE Automatic Transfer Unit

Removal of carbon smuts, oxide smuts, buffing and drawing compounds, grease and oil from: 1) steel, 2) malleable and grey iron castings, 3) brass, bronze and copper, 4) brass, bronze, copper and steel in the same cycle, 5) die castings, 6) electrolytic descaling of iron and steel, 7) preparing aluminum for anodizing, chromadizing, painting.

*BELKE Automatic Processing Units are also used for pre-painting and other treatments that require dipping, soaking, electrocleaning, etc. Send requirement details for recommendation.

Only BELKE Automatic Transfer Units offer all these advantages:

A. Automatically processes through any required cycle.* Any processing time from 10 seconds to 20 minutes. Available in a wide range of tank sizes.

B. Easily adjusted tank "skips" permit varied processing without changing solutions — make practical automatic processing of varied work from die cast parts to steel.

C. Processing time can be varied according to requirements of the work without changing plating time — processing is not rigidly geared to plating as is true with full automatic plating machines.

D. Automatic timing standardizes processing quality and sets the pace for production with no slow down. Partially loaded rods can be seen at a glance. The superintendent can quickly see slow downs and seek the cause and remedy.

Write for literature or send details of your requirements for recommendations

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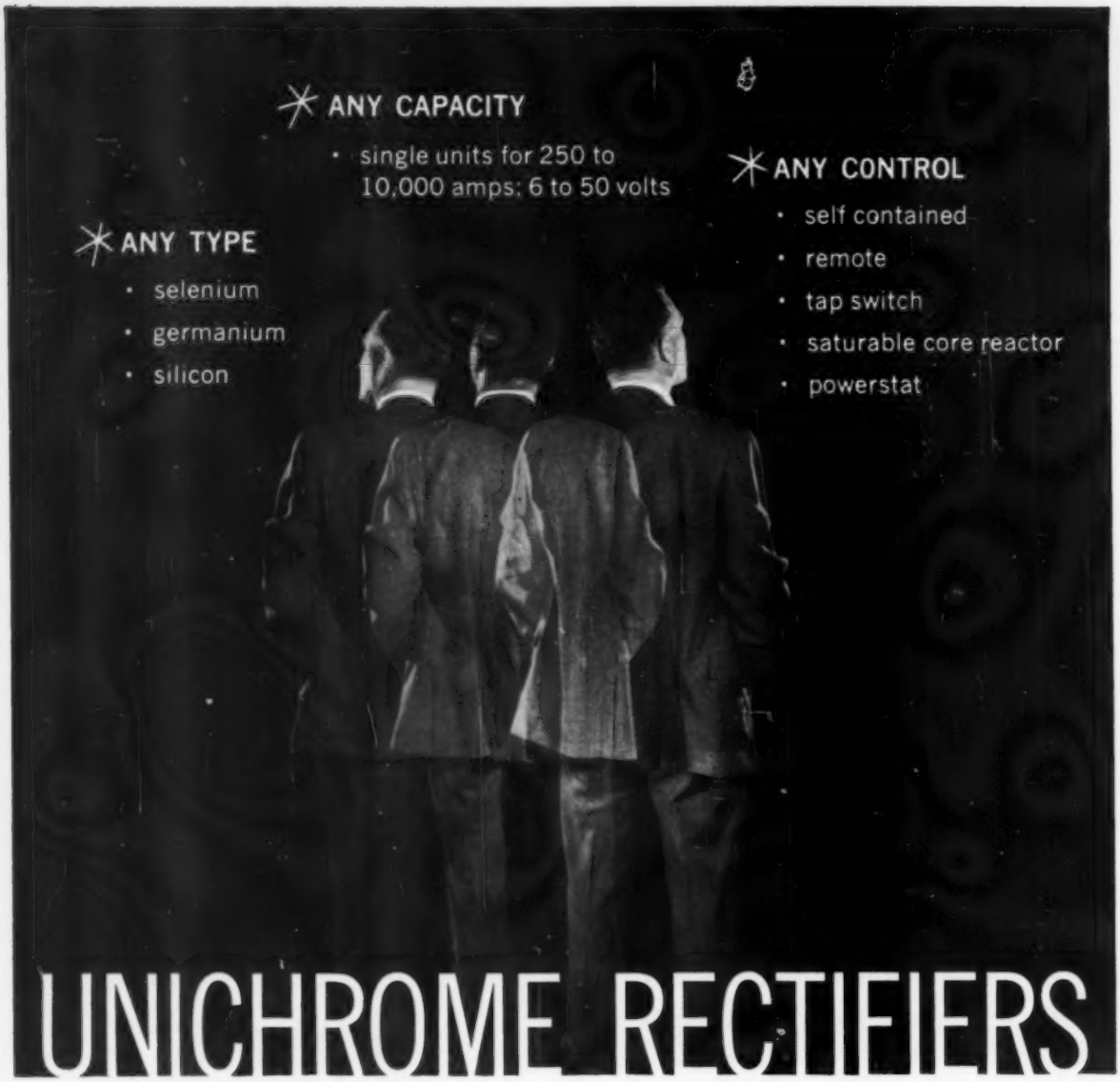

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And since Unichrome Rectifiers are available in all types, styles and sizes, a plater can be confident that recommendations are unbiased and based solely upon a desire to deliver optimum economy in plating. Call us in for a survey of your needs and our recommendation.

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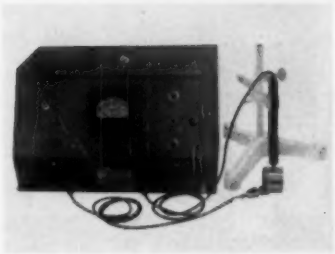
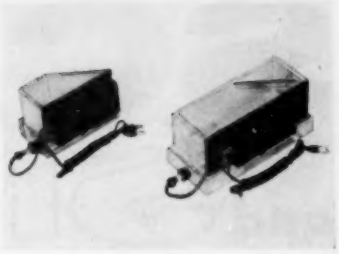


A dielectric thickness tester for anodic coatings on aluminum as specified in ASTM B110-45. Essential for every aluminum anodizing plant.

LUCITE MODEL "WT" 267 ml. and "WT" 1000 ml. HULL CELLS



With quartz heater and built-in thermostatic control; for plating baths at elevated temperatures. Also available without thermostat and heater in Lucite, Molded Polyethylene and Porcelain.

MODEL B1000-1-1 HULL CELL RECTIFIER

Has unusual refinements, accuracy and simplicity of operation for laboratory or bench plating. Output: 30 amps. D. C., at 13 volts for general use, or 6 amps. D. C., at 18 volts for Hull Cell use. Full wave rectification with output filtered to give 3% or less ripple; powerstat voltage control from zero to full voltage; dual ammeter; voltmeter.

NEW MODEL HANGING HULL CELL

Catches plating troubles at the source by spot checks. Just suspend the cell on the cathode busbar (as you hang a rack of work). Adaptable to any type of still or automatic plating.

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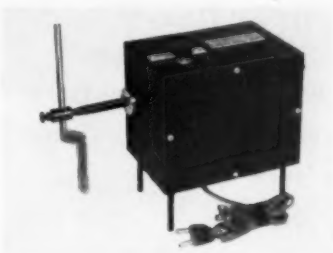

Simulates cathode rod agitation in Hull Cell by means of reciprocating motion of its paddle.

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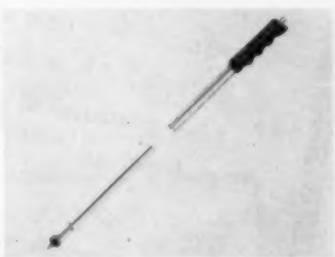

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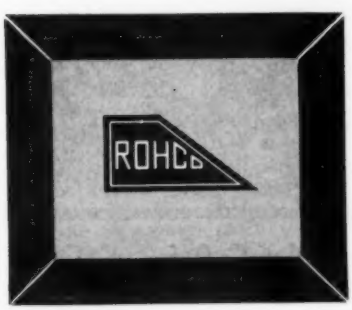

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Low Maintenance Cost

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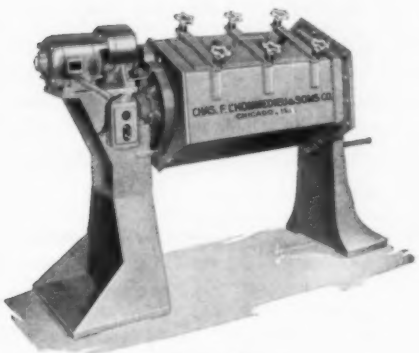

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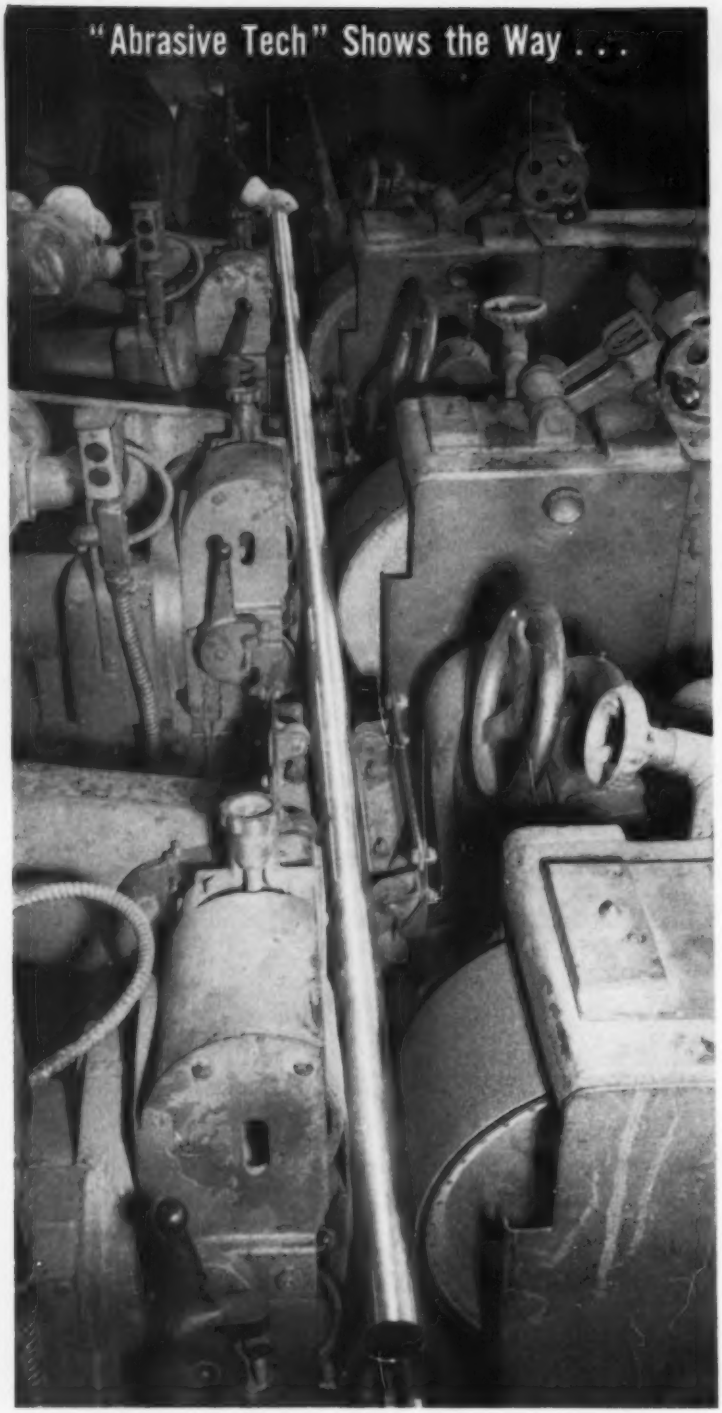

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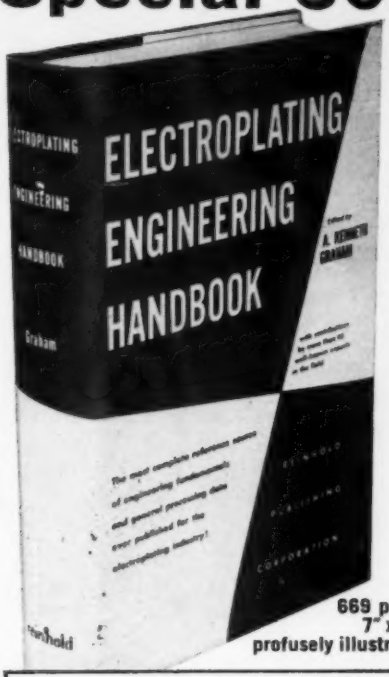

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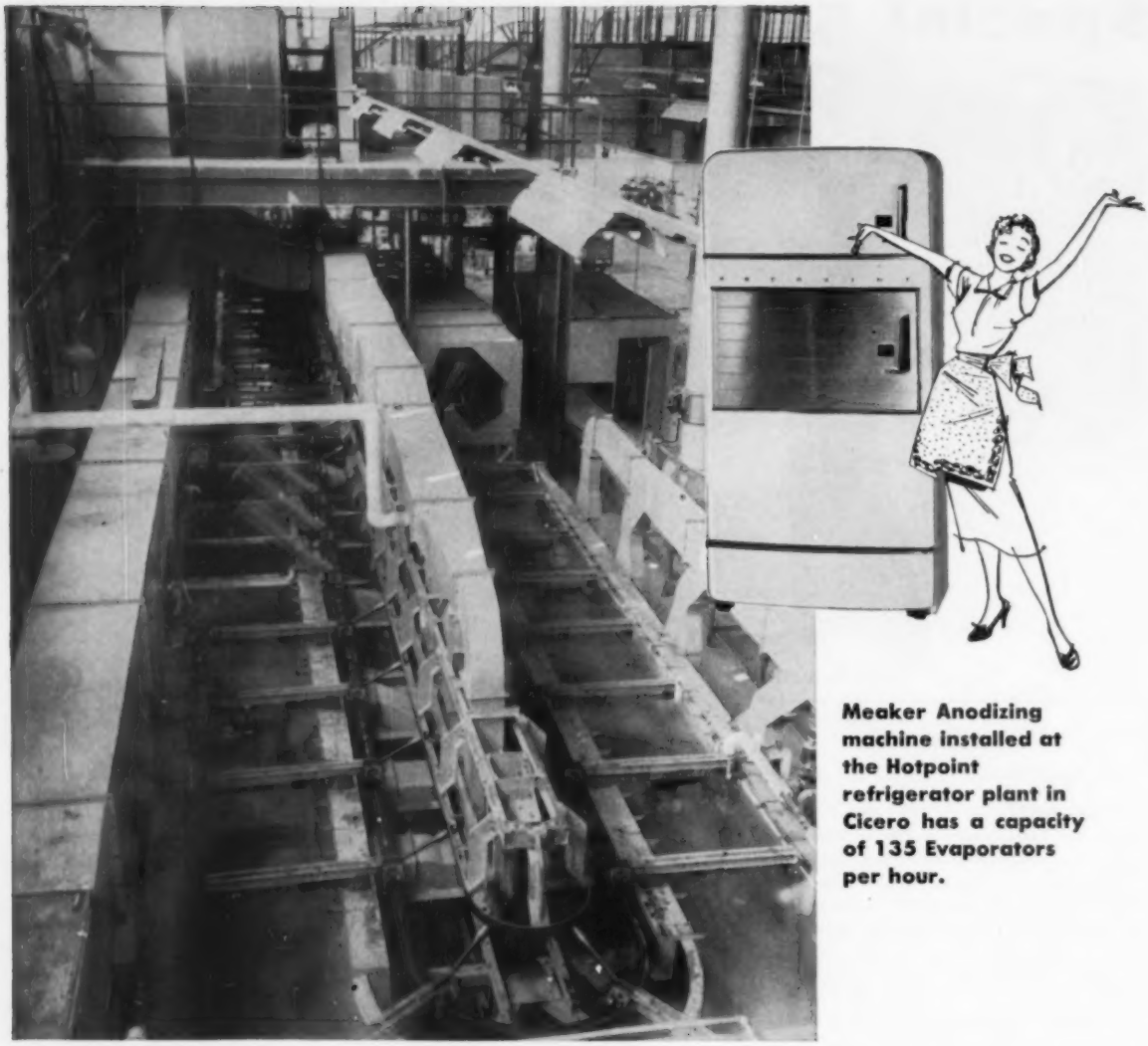

Meaker Anodizing machine installed at the Hotpoint refrigerator plant in Cicero has a capacity of 135 Evaporators per hour.

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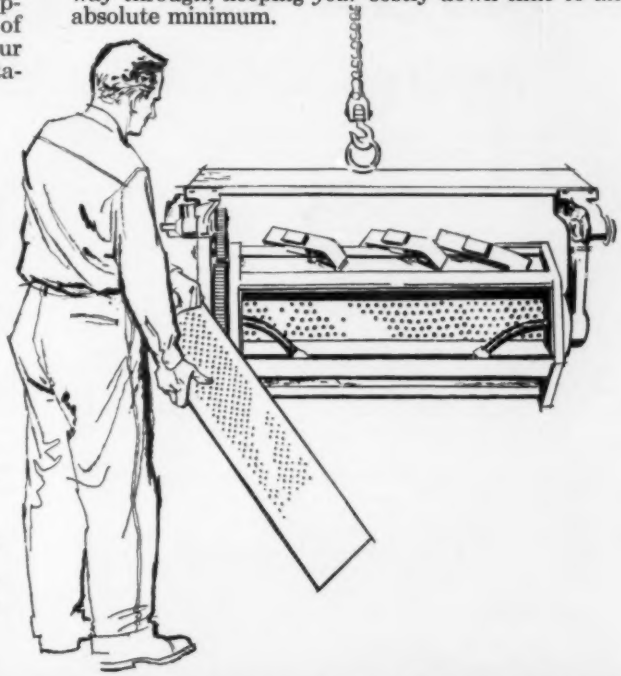

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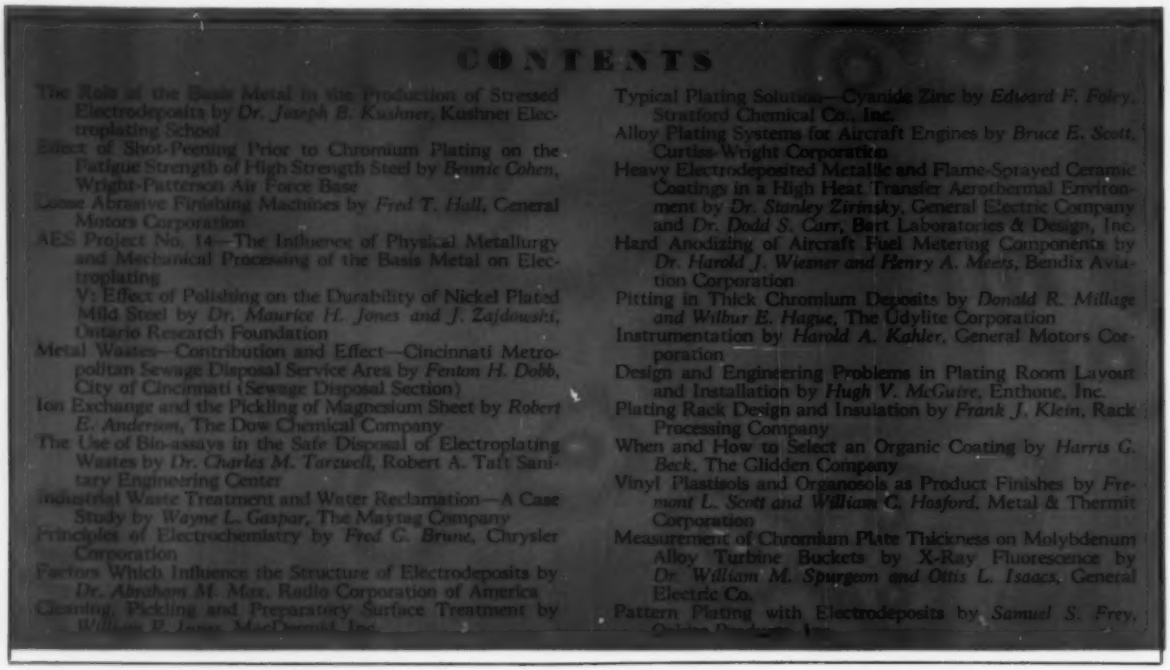

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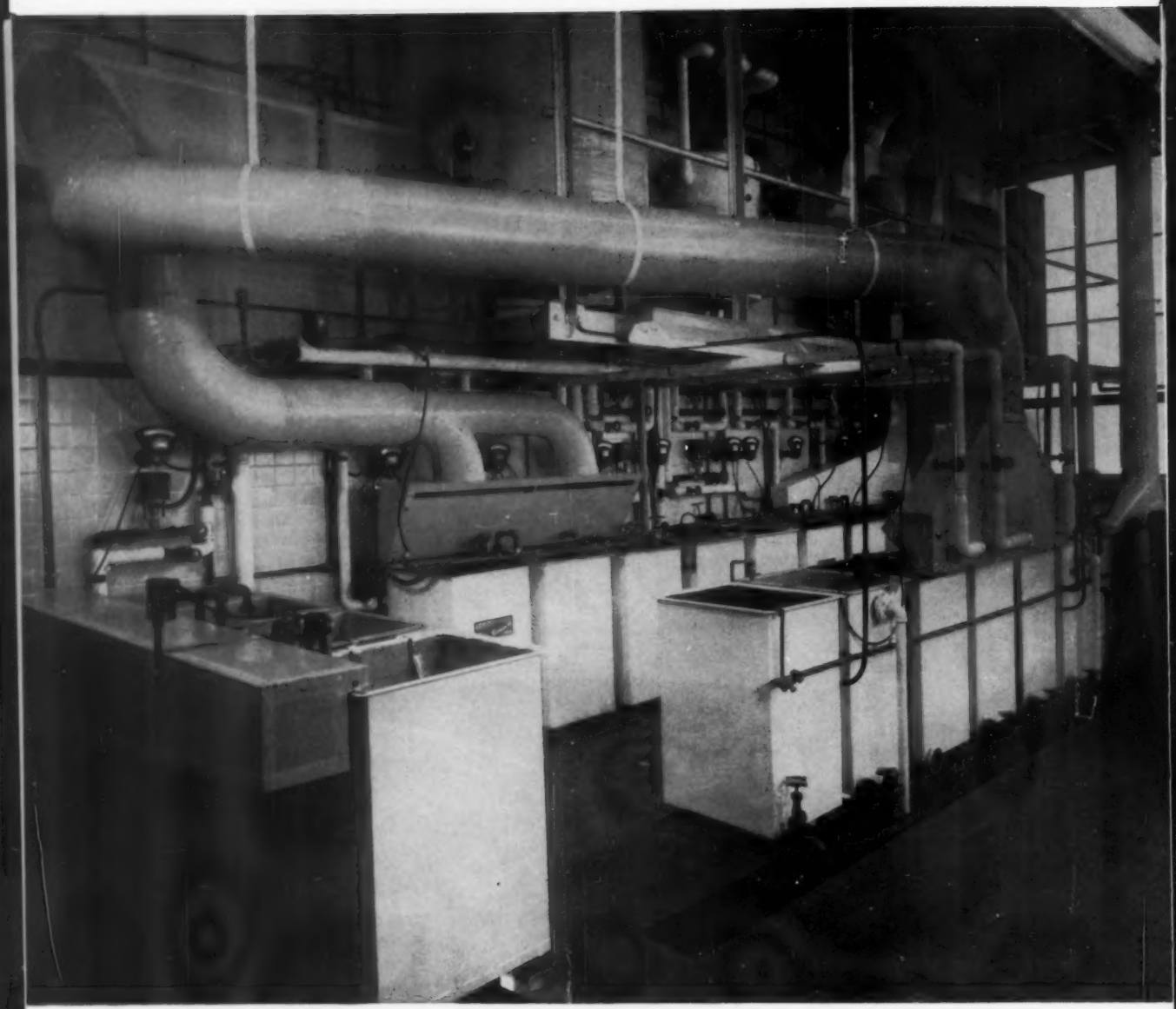

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PROGRESS ON ALLOY PLATING:

I. Tungsten and Molybdenum Alloys

by WILLIAM H. SAFRANEK* and LUTHER E. VAALER**

INTRODUCTION

FAUST PRESENTED IN 1940 A COMPREHENSIVE REVIEW of alloy plating, which included a discussion of the literature of tungsten and molybdenum alloys. More than 50 literature references on the subject have appeared since 1940. Interest in these alloys appears to have been due chiefly to the unusual electrochemical and metallurgical aspects of these alloy plating systems. Practical applications have been few in number, because the alloys have lacked ductility and because the plating baths are not easy to control.

Brenner, Burkhead and Seegmiller[6] carried out an investigation of tungsten alloy plating baths during World War II with the specific objective of determining their practicability. They derived considerable information on the properties of the deposits.

Iron, cobalt and nickel appear to be the only alloying elements that make possible the codeposition of substantial amounts of tungsten or molybdenum. Alloys of other metals can be produced, but very high current densities are required and current efficiency is very low. The amount of tungsten or molybdenum deposited is often so small as to raise the question whether it is really in an alloy or merely adsorbed on the surface or occluded as a salt.

ALLOYS OF TUNGSTEN

Iron, Cobalt and Nickel Alloys

Alkaline carbonate and acid fluoride baths were developed prior to 1940, and the reader is referred to the prior review.[14] Subsequently, a series of papers were published by Holt and his co-workers describing the deposition of alloys from well-known acid baths for iron,[28] cobalt,[31] nickel[32] and nickel-cobalt[26] to which were added small amounts of sodium tungstate. The solubility of the tungstate in the baths was limited to a few grams per liter, and the amount of tungsten in the deposits was small. The following modified Watts nickel bath is typical:

$NiSO_4 \cdot 7H_2O$—250 g/l
$NiCl_2 \cdot 6H_2O$—21 g/l
H_3BO_2—30 g/liter
W as $Na2WO_4 \cdot 3H_2O$—2 g/l
Current density—0.2 amp/sq dm (18.5 amp/sq ft)
Temperature—50 C (122 F)
*p*H—4
Tungsten in deposit—7.5 per cent
Cathode current efficiency—82 per cent

*Battelle Memorial Institute, Electrochemical Engineering Division, Columbus, Ohio.
**National Carbon Company, Process and Product Laboratory, Niagara Falls, New York.

A significant improvement was made over the acid baths by the development of slightly acid or alkaline baths in which the tungstate is much more soluble, and in which adequate amounts of iron, cobalt and nickel are held in solution by a complexing agent that is generally an organic acid. For some unknown reason, the presence of ammonia is essential to the deposition process, and in its absence the current efficiency is greatly reduced. The soundest deposits are generally obtained from hot baths, which evaporate ammonia at a rapid rate, making frequent or constant replenishment necessary.

A great fund of results has been obtained on the complexing baths in which variables of bath composition, *p*H, temperature, current density, etc., have been related to current efficiency and the composition of the deposit. Most of these data have been obtained and plotted in a search for a mechanism for the deposition process, but in most cases the objective has not been obtained. Whereas suggested hypotheses are compatible with the numerous results, the results themselves do not point to some unique mechanism. Nevertheless, several basic facts have emerged from this experimental work which will be discussed later.

Typical bath compositions and electrolysis conditions reported by several investigators for preparing nickel-tungsten alloys are listed in Table I. Similar information on cobalt and iron alloys is listed in Tables II and III, respectively. The values in parentheses are estimates for those cases in which the original reference was not explicit. It appears that deposits can be produced over a wide range of bath compositions, *p*H, current density and temperature. As a general rule, the higher temperatures produce sounder deposits. Considering the large range of conditions used, the composition of the deposited alloys is reasonably constant, at least for the cobalt and iron alloys. Thus, there appears to be a tendency for a stable composition somewhere below 35 per cent tungsten for the nickel alloys and 40 to 60 per cent tungsten for the alloys of cobalt and iron.

It has been amply demonstrated that the alloys are solid solutions[6, 22, 44] in contrast to the two-phase alloys that result from melting together the two metals. These alloys, then, are further examples of alloy electrodeposits with a structure representative of a metastable phase on the phase diagram and which otherwise exist at much higher temperatures than that used for deposition. The lattices of the deposited alloys are the same as those of pure iron, cobalt and nickel, but are slightly expanded by the introduction of the tungsten.

Physical properties have been determined in a few cases,

and Brenner et al. have made the most systematic study in this regard.[6] The hardness of their cobalt and nickel alloys ranged from 350 to 700 Vickers, while the hardness of the iron alloys was 700 to 900 Vickers. Because the alloys were thermally unstable solid solutions, they could be precipitation hardened at a temperature as low as 600 C without the usual preliminary heat soak to form the solution. Hardness was increased 100 points or more, and a value of 1400 Vickers was obtained for an iron-tungsten alloy, making it considerably harder than chromium. The hot hardness of the cobalt alloys at 700 to 800C was found to be as high as 370 Vickers, which is comparable to that of Stellite. The alloys were fairly brittle, and increasingly so in the order cobalt <nickel <iron. A cobalt-tungsten alloy containing 27 per cent tungsten was oxidized at 1050C about 10 times as fast as nickel and chromium electroplate.[66] Additional data on these properties are compiled in Table IV. The alloys were ferromagnetic up to a certain limit of tungsten content; the limit being 20 per cent for nickel, 30 per cent for cobalt, and somewhere above 50 per cent for iron alloys.

The corrosion properties of the alloy deposits have ranged from fair to mediocre. Cracks and pores in the deposits have hindered the evaluation of the inherent corrosion properties of the alloy. The qualitative tests that have been made are often contradictory, and no reliable conclusions can be drawn at present.

Ternary alloys of nickel-cobalt-tungsten[6, 26] and cobalt-iron-tungsten[6] have been deposited. Bath compositions were similar to those for the binary alloys; the deposits showed no unusual or unique properties.

TABLE I

NICKEL-TUNGSTEN ALLOY PLATING BATHS

Tungsten Content of Deposit per cent	Bath Composition: Compound	Molar Concentration	pH	Cathode Current Density amp/sq dm	Temperature C	Cathode Efficiency per cent	Properties	Reference
18 to 45	Nickel sulfate Tungstic oxide Ammonium sulfate Ammonium hydroxide	0.05 0.06 1.5 0.45	No data	10 to 600	70	Appx. 5	See Footnote*	54
35	Nickel sulfate Sodium tungstate Citric acid Ammonium hydroxide	0.076 0.15 0.34	8	7 to 15	90	40	Bright, but brittle and cracked	27 and 55
(1) 32 (2) 18	Nickel sulfate Tungstic oxide Sodium tartrate Ammonium sulfate Ammonium hydroxide	0.05 0.15 0.2 0.1	10	15	(1) 52 (2) 27	(1) 32 (2) 25	No data	21 and 22
20	Nickel sulfate Sodium tungstate Ammonium tartrate Ammonium sulfate Ammonium hydroxide	0.095 0.3 2.2 0.38	8.5	5	90	60	See Footnote†	6
No data	Nickel sulfate Tungstic acid Ammonium hydroxide	0.007 0.024 3.5	10	50	75	No data	Resisted sulfuric acid solution	2
No data	Tungstic acid Sodium hydroxide Tartaric acid Boric acid Sulfuric acid Nickel sulfate Sodium hydroxide	0.93 2.0 0.15 0.33 0.16 0.1	5.2 to 7.0	1.5 to 2	80 to 100	No data	Fcc structure	44

*Better than tungsten or nickel for resisting corrosion in potassium hydroxide solutions.
†Dull and gray or semibright; see Table IV for additional properties.

TABLE II

COBALT TUNGSTEN ALLOY PLATING BATHS

Tungsten Content of Deposit per cent	Bath Composition: Compound	Molar Concentration	pH	Cathode Current Density amp/sq dm	Temperature C	Cathode Efficiency per cent	Properties	Reference
60 to 65	Cobalt sulfate Sodium tungstate Citric acid Ammonium chloride Sodium hydroxide	0.14 0.3 0.57 0.93	8	15 to 20 (Interrupted for 1 sec after every 5 sec)	60	Up to 21	Sound, coherent, gray	23 and 24
36 to 51	Cobalt sulfate Sodium tungstate Tartaric acid Boric acid Sodium hydroxide	0.071 1.0 0.17 0.32	5.2 to 7.0	1.5 to 2	80 to 100	30	Bright, porous*	44
50	Cobalt sulfate Sodium tungstate Citric acid Sodium hydroxide	0.21 0.21 0.34	7	5 to 12	80	25 to 30	Bright	9 and 27
40	Cobalt sulfate Sodium tungstate Sodium, potassium tartrate Ammonium sulfate Ammonium hydroxide	0.089 0.076 1.4 0.38	8.5	5	90	90	Dull gray†	6
No data	Cobalt sulfate Sodium tungstate Citric acid Ammonium hydroxide	0.27 0.14 0.31	7	6.7	60	40	Bright	51

*Resisted hydrochloric, nitric, and sulfuric acid solutions.
†See Table IV.

Other Metals

Table V lists compositions for depositing tungsten alloys of several other metals. The current efficiency is known to be, or probably is, very low for all of these baths, and the results merely establish the fact that these metals can be codeposited in finite amounts. From the standpoint of physical metallurgy and physical chemistry, it might be argued that any solutions that dissolve tungsten to a finite extent should cause co-deposition of the tungsten in at least trace amounts in order to maintain an equilibrium potential with the ions in solution. This behavior hardly constitutes an unusual or practical type of electrodeposition.

Practical Uses

Brenner[6] suggested that the good throwing power of the cobalt-tungsten-tartrate bath coupled with the high hardness of the deposit should offer a practical advantage over hard chromium plating which has baths of poor throwing power and pointed out that bearings, pistons, cylinders, and dies would be suitable applications. Holt[27] mentions a limited use for nickel-tungsten alloys as a protective coating on rollers used in the manufacture of film. There may also be special applications in the petroleum industry. Tungsten alloy electroplate should be considered for any application requiring a hard surface layer at high temperatures, but cognizance must be taken of its relatively poor resistance to oxidation at high temperatures. Adler[1] has patented the use of deposits from the modified acid baths for forming strong rubber-to-metal bonds.

ALLOYS OF MOLYBDENUM

Binary Alloys With Iron, Cobalt and Nickel

Molybdenum behaves similarly to tungsten in that it is deposited with difficulty, if at all, as the pure metal, whereas the best results by far are obtained by codepositing it with iron, cobalt and nickel. Earlier work on tungsten alloy deposition pointed the way to similar baths for molybdenum alloys. For example, Yntema and Ksychi[59] developed an acid fluoride bath for deposition of the molybdenum alloys that is similar to the tungsten alloy baths patented by Armstrong and

Menefee[15] prior to 1940. Similarly, Brenner and Burkhead[5] have patented an alkaline carbonate bath for the molybdenum alloys along the same lines as the tungsten bath described earlier by Holt.[27] However, as with the tungsten baths, the greatest emphasis has been placed on formulations in which the Group VIII metals are complexed with ammonia and a tartrate, citrate or acetate radical. Typical compositions for such baths and the results obtained by various investigators are listed in Tables VI, VII, VIII, and IX. The data in these tables include information from relatively extensive studies undertaken in Russia.[15–22] Except for a few details relating to the control of plating bath and alloy deposit compositions, these investigations have been no more successful than the U.S.A. studies, judging from the published data.

The highest molybdenum content of the nickel alloys is about 25 per cent; of the cobalt alloys, 30 to 40 per cent; and of the iron alloys, 50 per cent in those cases where alloy composition is given. The evidence for constancy of alloy composition is less with the molybdenum than with the tungsten alloys. Typical temperatures for the molybdenum baths are much lower than for the tungsten baths.

Ernst[12, 13] carried out a detailed investigation of various complexing agents. Based on the weight gain and current density range of deposition in a Hull cell, he classified potassium citrate, sodium citrate, potassium sodium citrate, potassium tartrate, sodium tartrate, and potassium sodium tartrate as good complexing agents. Ammonium acetate, ammonium citrate, ammonium oxalate, sodium acetate, citric acid, gluconic acid, glycolic acid and tartaric acid were considered poor complexing agents. Ammonia was used for adjusting the *p*H of the baths. Apparently too high a concentration of ammonia in conjunction with the organic radicals is detrimental, although a certain minimum concentration is essential for deposition at a reasonable current efficiency. It is interesting to note that Yntema[57] was able to codeposit iron and cobalt, but not nickel from a strongly alkaline dextrose bath. This may be due to the fact that iron and cobalt oxides, but not nickel oxides, are slightly soluble in strong caustic solution.

The molybdenum alloys of iron, cobalt and nickel are reported to be solid solutions having the lattice characteristic of the Group VIII metal.[15, 17, 19, 20] The deposits reported were generally cracked, brittle and/or highly stressed. There-

TABLE III

IRON-TUNGSTEN ALLOY PLATING BATHS

Tungsten Content of Deposit per cent	Bath Composition — Compound	Molar Concentration	pH	Cathode Current Density amp/sq dm	Temperature C	Cathode Efficiency per cent	Properties	Reference
50	Ferric sulfate	0.21	8.5	5	90	40	See Table IV	6
	Sodium tungstate	0.2						
	Sodium citrate	0.3						
	Ammonium sulfate	0.38						
	Ammonium hydroxide							
50	Ferrous sulfate	0.036	8.0	5	70	30	—	39
	Sodium tungstate	0.15						
	Citric acid							
	Ammonium hydroxide							
36 to 51	Iron sulfate	(0.1)*	5.2 to 7.0	1.5 to 2	(1) 80 to 100	(1) 30 to 35	See Footnote†	44
	Tungstic acid	(0.93)			(2) 50	(2) 16		
	Sodium hydroxide	(2.0)						
	Tartaric acid	(0.15)						
	Boric acid	(0.33)						
	Sulfuric acid	(0.16)						
No data	Sodium tungstate	(1.2)*	14	12	80	No data	Could be diffused into substrate by heating at 1000 to 1200C	3
	Sodium pyrophosphate	(1.2)						
	Potassium chloride	(1.32)						
	Ammonium fluoride	(1.08)						
	Potassium ferrocyanide	(0.005)						
	Potassium hydroxide	(1.8)						
	Ethyl alcohol	(1.36)						
	Glycerol	(1.1)						

*Estimated concentration for figures in parentheses.
†Porous; darkened in moist air, but resisted hydrochloric, nitric and sulfuric acid; body-centered-cubic structure.

TABLE IV
PROPERTIES OF TUNGSTEN ALLOY ELECTROPLATES

Property	Tungsten-Nickel	Tungsten-Cobalt	Tungsten-Iron
Approximate W content	25 to 35	25 to 35	50
Tensile strength, psi	110,000 to 156,000[6]	No data	No data
Vickers hardness, as plated	500–700[6]	350 to 700[6, 46]	720 to 1000[6]
Vickers hardness, after heating	500–800[6]	350 to 1000[6, 46]	920 to 1400[6]
Ductility	None at room temp, but became ductile after heating at 1000C	None at room temp, but became ductile after heating to 1000C	None, either before or after heating
Young's modulus of elasticity, 10^6 psi	23 to 25	24 to 25[4]	23 to 25
Stress, psi	No data	30,000 to 40,000[4]	No data
Electrical resistivity at 20C, μohm-cm	No data	85 to 93, as plated 70 to 75, after heating	No data
Density, g/cu cm	10.6[6]	10.6[6]	No data
Coefficient of linear expansion, μinch/inch/°C, to 900C	No data	13.8[4] 16.2[46]	No data
Hot hardness, Vickers	No data	660 at 600C[46] * 340 at 800C[46] 220 at 800C[6]	No data
Permanent dimensional change after heating to 1050C, μinch/inch	No data	−8000[46] −2000 to −3000[6]	No data
High temperature oxidation rate, mg/sq cm/hour	No data	2.8[46]	No data
Ferromagnetic limit, per cent tungsten	20	30	50
Structure	Face centered cubic	Hexagonal, close packed	Body centered cubic

*Comparative hot hardness data for electroplated tungsten deposited in borate-tungstic oxide fused salt baths are as follows:[11]

Temp C	V.P.N. Hardness
600	91
800	71

TABLE V
BATHS FOR PLATING ALLOYS OF ANTIMONY, CHROMIUM, COPPER OR MANGANESE WITH TUNGSTEN

Codeposited Metal	Tungsten Content of Deposit per cent	Bath Composition: Compound	Molar Concentration	pH	Cathode Current Density amp/sq dm	Temperature C	Cathode Efficiency per cent	Properties	Reference
Antimony	No data	Potassium hydroxo antimonate	—	—	15	80	—	—	37
		Sodium tungstate	—						
		Boric acid	—						
Chromium	33	Chromic acid (reduced to Cr^{3+} with citrate)	2	8	210	70	0.05	See Footnote*	45
		Ammonium citrate	1.23						
		Tungstic oxide	0.43						
		Sulfuric acid	0.02						
Copper	2	Cupric sulfate	0.2	7	1.5	25		Metallic: adherent	10
		Sodium tungstate	0.0024						
		Citric acid	0.34						
		Ammonium hydroxide							
Manganese	14	Manganous sulfate	1.0	7	15	35		Metallic: adherent	10
		Sodium tungstate	0.0015						
		Citric acid	0.26						
		Ammonium sulfate	1.5						
		Sodium sulfite	0.048						
		Glycerol							
		Ammonium hydroxide							

*Resisted hydrochloric, nitric, sulfuric, and hydrofluoric acids; more protective than chromium plate in sodium chloride solutions; cracking was not observed upon microscopic examination.

TABLE VI

NICKEL-MOLYBDENUM ALLOY PLATING BATHS

Molybdenum Content of Deposit per cent	Bath Composition: Compound	Molar Concentration	pH	Cathode Current Density amp/sq dm	Temperature C	Cathode Efficiency per cent	Properties	Reference
25	Nickel sulfate Sodium molybdate Citric acid Ammonium hydroxide	0.23 0.033 0.34	8	20	25	40	Bright	49
25†	Nickel sulfate Molybdic oxide Rochelle salts Sodium chloride Ammonium hydroxide	0.07 0.125 1.33 1.0	10 to 10.5	7	25 to 40	37.3	Highly stressed, but adherent up to 10 microns; insoluble in acids and alkalies	15
20	Nickel sulfate Sodium molybdate Sodium citrate Ammonium hydroxide	0.3 0.2 0.3	10.5	10	25	80	Bright, cracked	12 and 13
No data	Nickel sulfate Molybdic oxide Ammonium acetate Potassium acetate Acetic acid	(0.002)* (0.03) (4) (3) (1)	6	25	35	1	—	58
No data	Nickel sulfate Molybdic oxide Potassium fluoride Hydrofluoric acid	(0.01) (0.36) (5.5) (1.6)	—	20	40	1	—	59
(1) 25† (2) 26† (3) 32†	Nickel sulfate Molybdic oxide Rochelle salts Sodium chloride Ammonium hydroxide	0.22 0.05 0.71 1.0	11	(1) 3 (2) 7 (3) 15	27	(1) 55 (2) 35 (3) about 5	—	21
(1) 20.9 (2) 10	Nickel sulfate Molybdic oxide Sodium chloride Ammonium hydroxide	(1) 0.3 (2) 0.2 (1) 0.167 (2) 0.047 0.05 3	10.6 to 10.8	10	20 to 30	(1) 3.6 (2) 54.5	—	22a
14	Nickel sulfate Molybdic oxide Rochelle salts Sodium chloride	0.2 0.063 1.33 1.0	10 to 10.5	7	25 to 30	75.7	Highly stressed; bright in low current area	15
No data	Nickel sulfate Molybdic oxide Sodium citrate Sodium chloride Ammonium hydroxide	0.1 0.1 0.58 0.12	11	1 to 200	25 to 30	No data	See Footnote‡	17
About 20	Nickel sulfate Molybdic oxide Sodium tartrate Ammonium hydroxide Sodium chloride	0.22 0.06 0.3 2.7 0.3	10.7	10	—	See Footnote§	—	60

*Figures in parentheses are estimated concentrations.
†Alloy anodes contained 70 per cent nickel and 30 per cent tungsten.
‡As little as 0.05 M molybdic oxide depolarized the cathode (i.e., .095 instead of 1.1 volt at 10 amp/sq dm).
§Nickel anode efficiency was about 40 per cent with 0.3 mol sodium chloride in the solution.

fore, there has been no need for an extensive investigation of physical properties as was carried out with some of the sounder tungsten alloy deposits. The results of evaluating the corrosion properties of the molybdenum alloys have been inconclusive, and no practical applications for the materials have been reported. Yet potential applications undoubtedly exist for the molybdenum alloys as highly permeable magnetic coatings, if a procedure can be developed for producing stress-free deposits with satisfactory physical properties. A unique type of complexing agent, as distinguished from the hydroxy acid radicals employed to date, appears necessary for achieving the desired physical properties.

Other Molybdenum Alloys

Table X shows baths and results for other alloys of molybdenum. Holt[27] investigated Ma's[8] chromium-molybdenum bath, but obtained less than one per cent of molybdenum in the deposit. Deposition of the quaternary alloys containing nickel, iron, molybdenum and manganese or copper[18] was carried out with the practical objective of making magnetic materials of the "permalloy" type. However, no data on the magnetic properties were reported.

MECHANISM OF CODEPOSITION

The free energy of formation of tungstate ($WO_4^=$) in alkaline solution is given as -220 kcal/mole by Latimer.* The corresponding value for molybdate ($MoO_4^=$) is -218.8 kcal/mole. Conceivably, stepwise reduction processes might occur, each involving a moderate reduction potential, but any such mechanism is improbable, particularly when an insoluble anode is present to reoxidize any partially reduced species. The free energy of formation values for tungstate and molybdate are considerably more negative than for chromate, which is cathodically reduced with difficulty in acid solution and not at all in basic solution.

Obviously, the high potential needed for reduction is not attained on pure tungsten or molybdenum cathodes even with the hydrogen overvoltage obtained at high current density. Theories for codeposition that postulate a catalytic action of the Group VIII metal or complex formation of the two metallic species in the bath do not avoid the necessity for the high potential. Of course, if the hydrogen overvoltage were higher on the alloy surface than on either of the pure components, it would be possible to postulate that the higher potential makes possible the deposition of tungsten or

*Latimer, W. M., Oxidation Potentials, Prentice-Hall, Inc., New York (1952).

TABLE VII

COBALT-MOLYBDENUM ALLOY PLATING BATHS

Molybdenum Content of Deposit per cent	Bath Composition: Compound	Molar Concentration	pH	Cathode Current Density amp/sq dm	Temperature C	Cathode Efficiency per cent	Properties	Reference
40	Cobalt sulfate Sodium molybdate Sodium citrate Ammonium hydroxide	0.3 0.2 0.3	10.5	10	25	50	Bright: cracked	12 and 13
30	Cobalt sulfate Sodium molybdate Citric acid Ammonium hydroxide	0.21 0.17 0.34	3	15	25	40	—	49
No data	Cobalt sulfate Sodium molybdate Sodium hydroxide Sodium carbonate Dextrose	(0.04)* (0.1) (6) (0.8) (0.1)		0.2	25		Bright: hard; resistant to sodium chloride	57
No data	Cobalt sulfate Molybdic oxide Ammonium acetate Potassium acetate Acetic acid	(0.007) (0.2) (4) (3) (1)	6	25	40	1	—	58
No data	Cobalt sulfate Molybdic oxide Potassium fluoride Hydrofluoric acid	(0.01) (0.2) (6) (2)	—	20	40	1	—	59

*Figures in parentheses are estimated concentrations.

molybdenum. However, it has been demonstrated repeatedly that the alloy deposition involves a substantially lower cathode potential than deposition of the Group VIII metal alone.[17, 33, 39, 50, 54] For example, Frantsevich-Zabludovskaya[17] found a decrease of potential of as much as 200 millivolts in depositing nickel-molybdenum alloys as compared to depositing pure nickel from a complexing bath. Similarly, Markwell[41] found a lowering of about 85 millivolts for iron-tungsten and nickel-tungsten alloys.

The observance of these lower cathode potentials has turned the attention of several investigators from the plating solution to the solid solution constituting the deposit. Solov'eva and Vagramyan[53] considered that the potential for tungsten deposition was reduced by alloying in the same

TABLE VIII

IRON-MOLYBDENUM ALLOY PLATING BATHS

Molybdenum Content of Deposit per cent	Bath Composition: Compound	Molar Concentration	pH	Cathode Current Density amp/sq dm	Temperature C	Cathode Efficiency per cent	Properties	Reference
61*	Sodium molybdate	1.0	8	14	50	20 to 44	See Footnote†	7, 38, and 43
	Ferric chloride	0.1						
	Sodium pyrophosphate	0.4						
	Sodium bicarbonate	0.9						
50	Ferrous sulfate	0.216	6.0	15	25	15		49
	Sodium molybdate	0.0165						
	Citric acid	0.343						
	Ammonium hydroxide							
50	Ferrous sulfate	0.3	10.5	10	25	15	Gray, metallic	12 and 13
	Molybdic oxide	0.2						
	Sodium citrate	0.3						
	Ammonium hydroxide							
No data	Ferrous sulfate	(0.02)‡	6	20	30	(1)		58
	Molybdic oxide	(0.2)						
	Potassium hydroxide	(5)						
	Ammonium hydroxide	(4)						
	Formaldehyde	(8)						
No data	Ferrous sulfate	(0.02)‡		20	40	(1)		59
	Molybdic oxide	(0.2)						
	Potassium fluoride	(5)						
	Hydrofluoric acid	(1.5)						
No data	Ferric sulfate	0.1	11	0.1 to 0.5	25 to 30	No data		17
	Molybdic oxide	0.04						
	Sodium citrate	0.58						
	Sodium chloride	0.12						
	Ammonium hydroxide							
No data	Ferrous sulfate	(0.04)‡	—	0.2	25	—	Bright; very hard	57
	Sodium molybdate	(0.1)						
	Sodium hydroxide	(6)						
	Sodium carbonate	(0.8)						
	Dextrose	(0.1)						
No data	Molybdic oxide	0.83	—	—	—	—	—	43
	Ferric chloride	0.04						
	Sodium pyrophosphate	0.18						
	Sodium bicarbonate	1.79						

*Deposit contained 6 per cent oxygen.
†Plate 0.01 mm thick was lustrous and contained microscopic cracks; thicker plate was dull and rough; resisted sulfuric and hot hydrochloric acid solutions.
‡Figures in parentheses are estimated concentrations.

TABLE IX

BATHS FOR PLATING ALLOYS OF NICKEL AND IRON WITH MOLYBDENUM

Molybdenum Content of Deposit per cent	Bath Composition: Compound	Bath Composition: Molar Concentration	Bath Composition: pH	Cathode Current Density amp/sq dm	Temperature C	Cathode Efficiency per cent	Properties	Reference
5*	Nickel sulfate	6.5	10.5	(1) 5	25 to 30	(1) 80	(1) Bright; cracked	19
	Ferric sulfate	0.65	to 11	(2) 30		(2) 65	(2) Dull; dense	
	Molybdic oxide	0.03						
	Sodium chloride	0.1						
	Sodium citrate	0.2						
	Ammonium hydroxide							
3	Nickel sulfate	0.11	11	16	30	80	—	19
	Ferric sulfate	0.079						
	Molybdic oxide	0.0063						
	Sodium chloride	0.12						
	Sodium citrate	0.42						
	Ammonium hydroxide							
No data	Nickel sulfate	0.2	11		25 to 30		—	17
	Ferric sulfate	0.025						
	Molybdic oxide	0.01						
	Sodium citrate	0.58						
3†	Ferrous ammonium sulfate	0.03	2.7	0.5 to 7	25		Alloy containing more than 3 per cent molybdenum was cracked and brittle	56
	Nickel sulfate	0.8						
	Sodium citrate	0.0001						
	Sodium chloride	0.17						
	Boric acid	0.4						
	Saccharin	0.05						
	Molybdic oxide	0.0014						

*Ternary alloy anodes.
†Iron content was about 20 per cent, balance was nickel.

manner as it is for sodium reduction to form an amalgam with mercury. They suggested the formation of a compound of type Fe_2W. Frantsevich-Zabludovskaya[17] postulated some special bonding between the alloying components, giving rise to a lower deposition potential that can be obtained at the cathode. Davis and Gentry,[11] in reviewing the status of tungsten alloy plating, came to much the same conclusion after noting that the density of an alloy was considerably higher than could be accounted for by an ideal mixing of the two alloying components. This means that there is an unexpected "shrinkage" during codeposition. They ascribe the high density to a very strong bonding between the components. Further evidence for such strong bonding is implicit in the results of Holt, et al. with acid plating baths. The Group VIII metals are deposited from such baths at modest potentials, and the deposition of tungsten would not be expected unless the potential was much higher. It is surprising that there was any tungsten at all in deposits from the acid baths; yet, alloys containing 5 to 10 per cent tungsten were readily obtained. This result is readily explained if a high negative free energy of formation is assumed for the alloy. Evidence for strong bonding also is furnished by the tendency toward constant composition for deposits from complexing baths. The composition represents a solubility maximum above which the negative free energy of formation for the alloy decreases rapidly.

Experimental consideration of the alloy rather than the plating bath would appear to be a most fruitful approach for further work, and a classical thermodynamic approach is suggested. Heats of combustion of several alloy compositions would be compared with those for the pure components. The entropy change on alloying would probably be small by comparison, and an estimate could be calculated for a solid solution. The free energy of alloy formation and the reduction in potential to be expected under reversible conditions could then be calculated. This may offer at least a partial explanation for codeposition, and would furnish a firmer basis for the further study of overvoltage effects.

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TABLE X

BATHS FOR PLATING ALLOYS OF CHROMIUM, COPPER, MANGANESE OR TUNGSTEN WITH MOLYBDENUM

Codeposited Metal	Molybdenum Content of Deposit per cent	Bath Composition: Compound	Molar Concentration	pH	Cathode Current Density amp/sq dm	Temp C	Cathode Efficiency per cent	Properties	Reference
Chromium	30	Chromic acid Molybdic oxide Sulfuric acid	1.3 0.3 0.013		15	40	22	Dense; resisted hydrochloric, hydrofluoric, and nitric acid	8
Chromium	1.7	Chromic acid Molybdic oxide Sulfuric acid	4.0 2.0 0.04		15	40	—	—	50
Chromium and nickel	2.7 to 7.75	Chromic sulfate Sodium sulfate Ammonium molybdate Boric acid	1.63 0.65 0.51 0.16	2	5 to 10	40	5	Dull, gray to bright	16
Copper* and iron	4 to 7	Copper sulfate Nickel sulfate Ferric sulfate Molybdic oxide Sodium chloride Sodium citrate Ammonium hydroxide	0.0008 0.2 0.079 0.0063 0.12 0.42	11	15	30	—	—	18
Manganese† and iron	4 to 7	Manganese sulfate Nickel sulfate Ferric sulfate Molybdic oxide Sodium chloride Sodium citrate	0.045 0.2 0.079 0.0063 0.12 0.42	11	15	30	—	—	18
Tungsten and cobalt‡	21	Cobalt sulfate Sodium tungstate Sodium molybdate Ammonium hydroxide	0.23 0.16 0.07	4.0	5	25	75	—	42

*Copper content was approximately 0.5 per cent.
†Manganese content was approximately 0.5 per cent.
‡65 per cent cobalt and 13 per cent tungsten.

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THICKER DECORATIVE CHROMIUM FOR BETTER CORROSION RESISTANCE

by E. J. SEYB and W. H. ROWAN*

ONE OF THE PRINCIPAL PROBLEMS confronting the plating industry is the frequently unsatisfactory corrosion resistance of decorative-protective coating systems. It was confidently expected that the situation would improve when war-engendered metal shortages no longer dictated the use of substandard plating thicknesses, but such hopes have not been entirely realized. Evidently some new factors have entered the picture: these perhaps include exposure to more corrosive environments, and the fact that the usual bright nickels do not provide as good protection as buffed Watts' nickel.

Since the restoration of former, supposedly adequate, thicknesses of nickel (or copper-nickel) did not give adequate performance, attention was directed to the chromium overlay, which had conventionally been thought of only as a tarnish-resistant and coloring "flash" contributing little or nothing to corrosion resistance. Studies of the nature and thickness of the chromium, as they affected performance, quickly showed that the final chromium layer itself was a very important factor. This paper intends to show that chromium, properly applied, can contribute as much corrosion resistance as many times an equal thickness of copper or nickel.

Studies of corrosion protection have been greatly aided by the recent development of two improved accelerated tests —the Corrodkote and the copper-accelerated acetic acid salt spray (CASS)—which resulted from the work of AES Research Project 15.[1] These tests have at least three advantages over the conventional neutral salt spray: they are (1) more reproducible, (2) faster, and (3) more indicative of actual service performance. Although additional experience with these tests will be needed before they can be finally accepted as standards, they are obviously major advances in corrosion testing. In this paper both of these tests, as well as exposure on outdoor racks, will serve as criteria of judgment.

In 1953 Stareck and Dow[2] of this laboratory showed that a relatively thick crack-free chromium deposit could provide excellent corrosion resistance unassisted by undercoatings. The introduction of bright crack-free chromium in 1957[3] provided the opportunity for the utilization of this favorable property in the decorative field. Brown, et al,[4] Sample,[5] Safranek and Faust[6] have also reported the advantages of heavier chromium deposits: the latter authors showed that with crack-free chromium increasing the chromium thickness from 0.01 to 0.08 mil (10 to 80 millionths of an inch) had more beneficial effect than increasing the nickel thickness from 0.8 to 1.6 mils—in other words, that 0.07 mil additional chromium gave more improvement than 0.8 mil additional nickel.

*Metal and Thermit Corporation, Detroit, Michigan.

These were not, of course, the first investigations of the effect of chromium thickness on performance. Several earlier studies had shown that improvement resulted when the chromium was increased from zero to about 0.02 mil, but beyond that thickness the performance fell off again. Although some reports were not in agreement with these findings, the industry in general acted on the assumption of their validity.

One of the first articles to show that about 0.02 mil of chromium, over nickel, represents an optimum with performance dropping off on either side, is that of Baker and Pinner.[7] Fig. 1 represents their results. Hours to failure in conventional salt spray are plotted vs. thickness of chromium, the undercoating being 0.3 mil copper + 0.6 mil nickel. Steady improvement is observed up to approximately 0.02 mil followed by a decline beyond 0.03 mil. They summarize

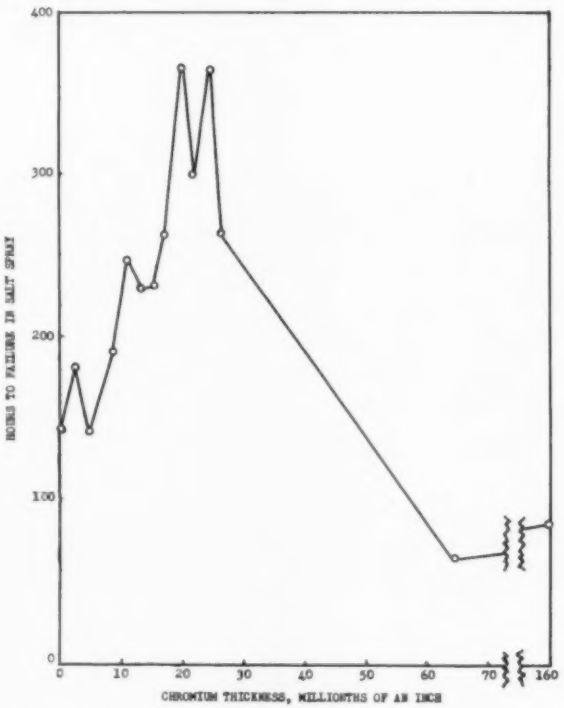

Fig. 1. Effect of Cr thickness on hours to failure in salt spray (Baker and Pinner[7]). 0.3 mil Cu + 0.6 mil Ni on steel.

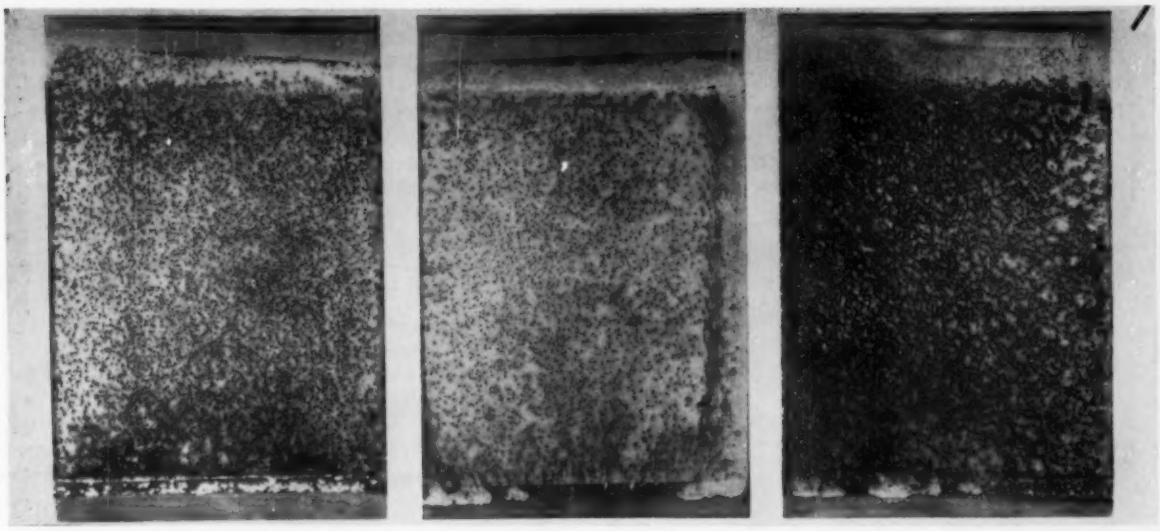

Fig. 2. Effect of thickness of cracked Cr over thin undercoatings. Cr 0.01, 0.02 and 0.05 mil over 0.5 mil Cu + 0.5 mil Ni on steel. Outdoors, Detroit, 2 years.

their results as follows: "increasing the amount of chromium deposited on nickel and copper up to a thickness of 10 to 20 millionths of an inch increases the protective value, but a further increase of thickness—decreases the protective value to almost the results obtained with no chromium". These results fit into a pattern observed by many since that time and have been associated with cracks in the chromium. When cracking occurs, poor corrosion results follow.

Blum, Strausser and Brenner[8] published results which were at variance with those of Baker and Pinner: they showed that as the chromium thickness was increased from 0.05–0.1 mil, the performance continued to improve: in fact, this relatively slight increase in chromium was more valuable than doubling the thickness of the undercoating. But their findings were not widely credited in the industry and in fact surprised the authors themselves, who stated: "the greater protective value in most locations of the relatively thick chromium coatings, 50 to 100 millionths of an inch, is surprising in view of the previously reported greater porosity of such coatings which was confirmed by tests from a copper deposition method on specimens similar to those in the exposure test. The value of thick chromium deposits is illustrated by the fact that after two years exposure, a set (of test panels) with one mil of undercoating and 100 millionths of an inch of chromium is superior to any other set with this same thickness of nickel or of copper plus nickel and is about equal to sets which have two mils undercoat and 20 millionths of chromium."

The apparent contradiction in the above references will be analyzed later in the light of the following data.

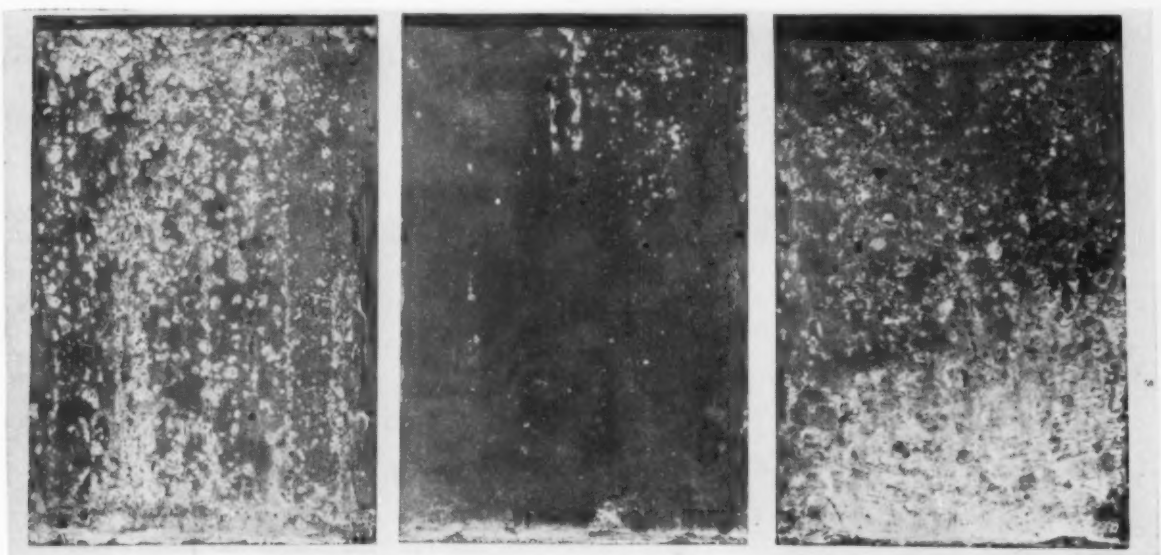

Fig. 3. Effect of thickness of cracked Cr over thin undercoatings. Cr 0.007, 0.015 and 0.03 mil over 0.4 mil Ni on steel. CASS test, 32 hours.

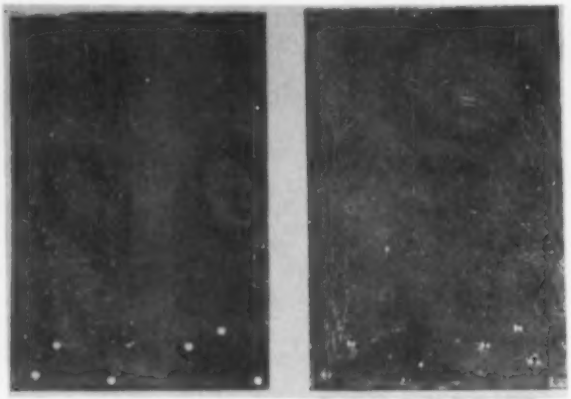

Fig. 4. Effect of thickness of cracked Cr over thin undercoatings. Cr 0.01 and 0.04 mils over 0.6 mil Cu + 0.7 mil bright Ni on steel. Corrodkote test 20 hours + salt spray 4 hours (White spots at bottom of panels are holes from identification code.)

Chromium Over Insufficient or Brittle Nickel

Fig. 2 illustrates the effect of atmospheric exposure at Detroit for two years on steel panels respectively with 0.01, 0.02 and 0.05 mil of cracked chromium over 0.5 mil of copper plus 0.5 mil of bright nickel. The panel with 0.02 chromium shows better results than the one with 0.01 but at 0.05 the pattern is reversed as cracking of the deposit is noted.

Fig. 3 illustrates the same effect after 32 hours exposure in the CASS test. Steel panels were plated respectively with 0.007, 0.015 and 0.03 mils of chromium over 0.4 mils of bright nickel. The panel with 0.007 mil shows considerable rusting, the one with 0.015 is better but again the crazed one with 0.03 is worse.

Another example is shown in Fig. 4 using the Corrodkote test. Here 0.01 and 0.04 mil of chromium were plated over 0.6 mil of copper plus 0.7 mil of bright nickel on steel. Both panels are badly corroded. The first has too little chromium to give protection while the second is crazed and corrosion products are visible in the cracks.

The common factors in the above instances are (1) in each case, the thicker chromium is cracked and (2) the undercoatings, notably nickel, are all relatively thin. Under these conditions, protection does not continue to improve after cracking takes place with increased chromium thickness. Instead, the cracks in the chromium provide points through which corrosive media can pass and attack the underlying coatings and, within a reasonable period of time, the base metal itself. The recent interest in chromium deposits which are both bright and crack-free has prompted an investigation into the effect this type of plate has over thin undercoatings of nickel.

Fig. 5 shows panels plated with 0.5 mil of copper plus 0.5 mil of nickel followed by 0.01, 0.02 and 0.05 mil of crack-free chromium. Exposure was for two years in the Detroit atmosphere. The panel with 0.01 mil is covered with rust, the one with 0.02 is better but the one with 0.05 is much better, rating 5 by the ASTM method.[9] Thus with crazing eliminated, corrosion protection continues to improve with increasing thickness of chromium. Within experimental reproducibility, the panels with 0.01 mils of chromium in Figs. 2 and 5 are alike for both chromiums as far as basis metal protection is concerned although the panel for 0.01 mil in Fig. 2 is slightly lighter in color in the photographs. The panels with 0.02 mils are identical for the two sets. It is when the chromium thickness is increased that the crack-free chromium shows the better basis metal protection while cracked chromium shows rusting through the chromium craze lines with this relatively thin undercoating.

In Fig. 6, the CASS test demonstrates the same effect. Here 0.015, 0.03 and 0.045 mil of crack-free chromium were plated over 0.4 mil of nickel on steel. Exposure was for 48 hours. Again improved results are observed with increasing thickness.

Our unpublished laboratory results indicate that additional thickness of crack-free chromium is able to do more in corrosion protection than relatively larger amounts of nickel. From the many tests made, it was found that 0.01 mil of crack-free chromium is equivalent to about 0.3 to 0.4 mil of nickel; a difference in order of magnitude of some 30 fold or several thousand per cent.

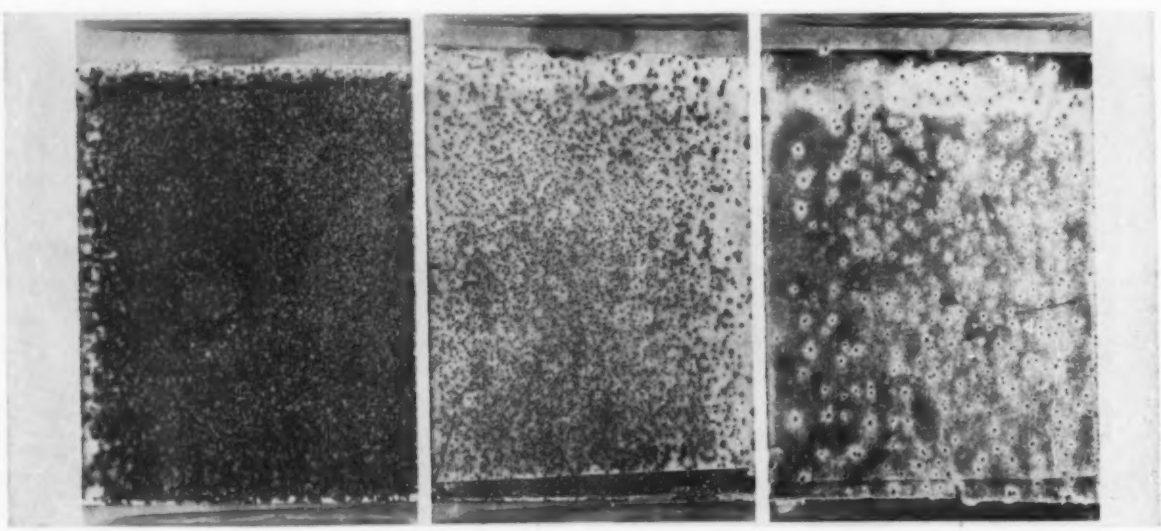

Fig. 5 Effect of thickness of crack-free Cr over thin undercoatings. Cr 0.01, 0.02 and 0.05 mils over 0.5 mil Cu + 0.5 mil bright Ni on steel. Outdoors, Detroit, 2 years.

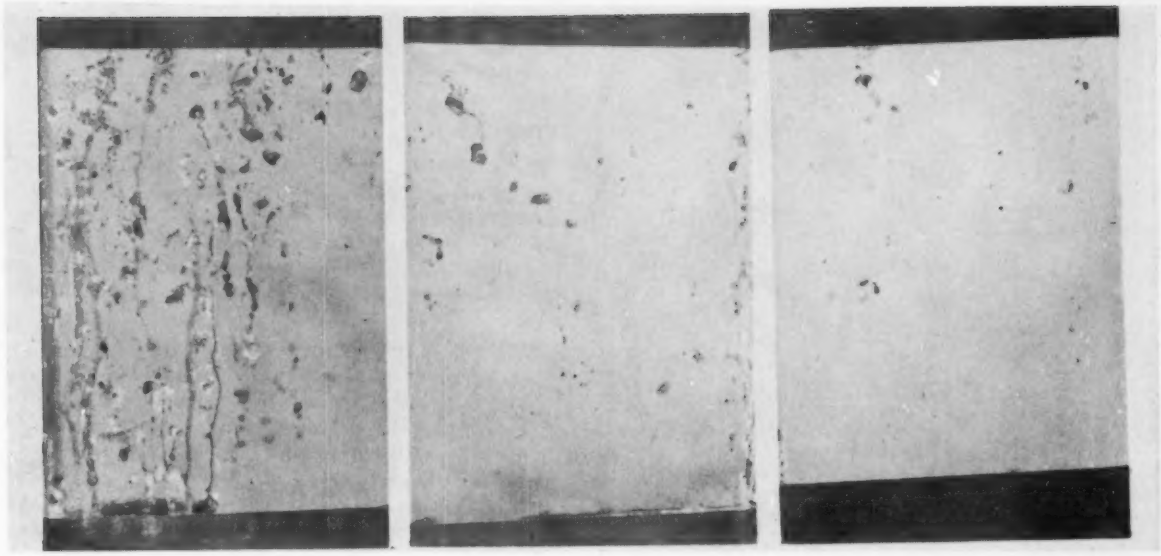

Fig. 6. Effect of thickness of crack-free Cr over thin undercoatings. Cr 0.015, 0.03 and 0.045 mil over 0.4 mil Ni on steel. CASS test, 48 hours.

It should be noted that 0.05 mil of crack-free chromium is by no means an upper limit; performance continues to improve as the thickness is increased. In an unpublished paper presented at the annual meeting of the Atlanta Georgia Branch, February 8, 1957, Mahlstedt introduced bright crack-free chromium and among other things, showed samples and data demonstrating that corrosion resistance improved not only rapidly but continuously as the thickness of crack-free chromium was increased to approximately 0.1 mil (100 millionths of an inch). In fact, the only upper limit for decorative applications appears to be the thickness at which either brightness begins to deteriorate or the deposit begins to crack, and these limits are being continually raised by constant research.

Cracked Chromium on Thicker Undercoatings

When the undercoating is thick enough to withstand the stress caused by cracking of the chromium, the limitations discussed above do not apply and advantage can be taken of the additional protection afforded by heavy chromium, even if it is cracked. Some but not all bright nickels are sufficiently ductile to qualify for this treatment. Those that qualify must be carefully maintained and frequently purified to prevent loss of ductility by excesses of brightener, heavy metal impurities or other contamination. Fig. 7 illustrates these points clearly. Two thicknesses of chromium, 0.015 and 0.03 mil, were deposited on two thicknesses of undercoats: 0.5 mil bronze + 0.5 mil bright nickel, and 1.0 mil bronze + 1.0 mil bright nickel. All panels were exposed in the CASS test for 60 hours. On the thinner undercoating, 0.015 mil of chromium permitted rusting of the steel while with 0.03 mil green corrosion products of the bronze were evident, but the appearance ratings of the two panels were about the same. With the thicker undercoats the effect is quite different. Doubling the undercoat thickness improved the performance only slightly, but doubling the chromium thickness raised the ASTM rating from 3 to 9, a 99 per cent reduction in corroded area. As Fig. 7 shows, this improvement is due not to the undercoat alone or the chromium alone, but to the combination. The heavier chromium has a relatively fine crack pattern typical of these deposits; it

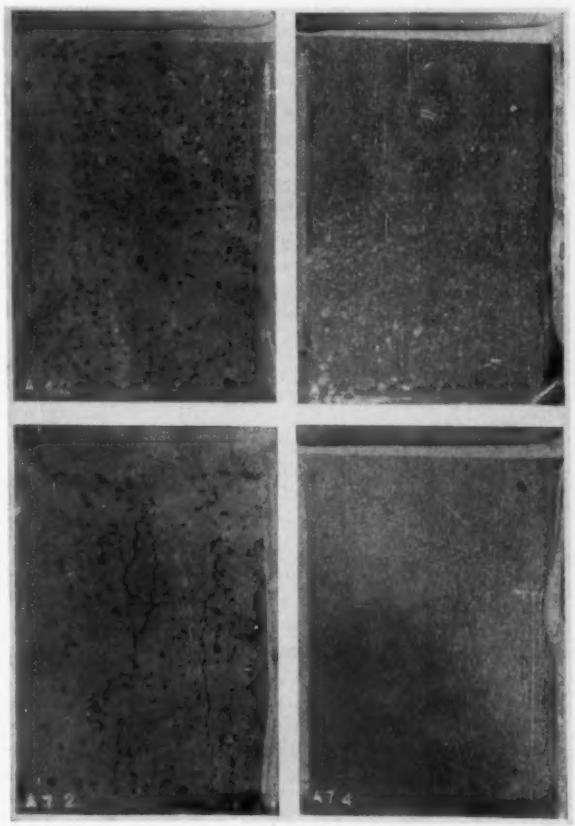

Fig. 7. Effect of thickness of cracked Cr on heavier undercoatings. Top: 0.5 mil bronze + 0.5 mil bright Ni + 0.015 (left) and 0.03 (right) mil Cr. Bottom: 1.0 mil bronze + 1.0 mil bright Ni + 0.015 (left) and 0.03 (right) mil Cr. CASS test, 60 hours.

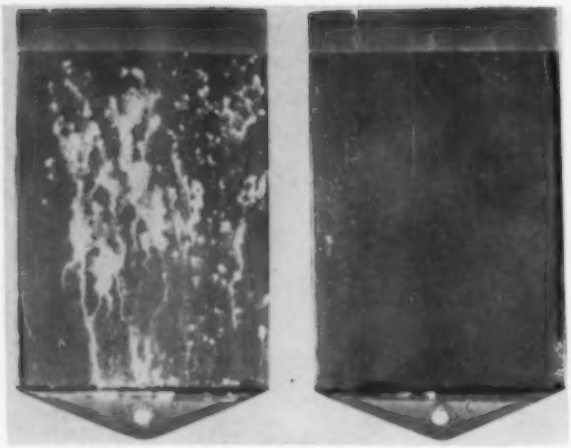

Fig. 8. Effect of thickness of cracked Cr on heavier undercoatings. Cr 0.02 and 0.05 mil over 0.4 mil Cu + 1.0 mil Ni on zinc-base die casting. CASS test, 60 hours.

can be seen only on close and critical examination after the corrosion test. The acceptability of such a crack pattern can be determined only by the individual customer, but it seems evident that it is far preferable to pitting and corrosion of the basis metal.

Similar dramatic improvement is obtained when zinc-base die casting is the basis metal, as shown in Fig. 8. This shows panels plated with 0.5 mil copper + 1.0 mil nickel, followed by 0.02 and 0.05 mil chromium, and subjected to the CASS test. The ASTM rating was raised from 3 to 8 by the additional chromium.

The same results are obtained in the Corrodkote test. Figure 9 shows the improvement afforded by increasing the chromium thickness from 0.01 to 0.04 mil, over 0.6 mil copper + 1.4 mil bright nickel.

Outdoor exposure tests confirm the results of these accelerated tests. Fig. 10 illustrates three panels plated with 0.6 mil copper + 1.4 mil bright nickel, with 0.01, 0.04 and 0.075 mil chromium, which have been exposed to the atmosphere of Detroit for one year. The left panel with 0.01 mil chromium is covered by countless small surface pits which downgrade the panel to a low rating and foreshadow early failure. On the other hand, the panels with 0.04 and 0.075 mil chromium show microscopic cracking which is barely visible and there is no pitting of the chromium nor basis metal corrosion.

This laboratory cooperated with ASTM Committee B8, Sub II, in the preparation of panels for its program 4 in 1954; we plated 0.005, 0.01, 0.03 and 0.06 mil of both SRHS* and ordinary chromium over 1.5 mil nickel on steel. These panels have been on exposure at Kure Beach and Detroit for 2.5 years; their condition distinctly shows the improvement in basis metal protection provided by the heavier chromium, as well as the extent to which crazing develops. A somewhat different picture appears at the two exposure sites: in the industrial environment of Detroit, the crazing is hardly visible when the panels are cleaned, while the improvement in protection afforded by the thicker chromium, already discussed, is once more evident. At Kure Beach the corrosion protection again improves as the chromium is increased (for example 0.01 mil SRHS rated 1, 0.03 mil rated 9) but the craze pattern is considerably more obvious than at Detroit. Whether or not this pattern is acceptable must be determined by the user.

*Proprietary chromium plating bath, Metal & Thermit Corp.

Discussion

Recent studies[3] have shown that increasing the thickness of crack-free chromium over thick, as well as thin, nickel undercoatings results in a marked improvement in corrosion protection. This means that the data shown in Figs. 5 and 6 for thin nickel would also apply as the nickel thickness is increased into the ranges commonly in use today. It, therefore, becomes obvious that the unique, crack-free characteristic of this type of chromium enables it to provide improved corrosion protection with increasing chromium plate thickness, regardless of the thickness of the underlying nickel coating. The crack-free structure also means that there is no problem of craze corrosion of the underlying nickel deposit.

The results set forth above, and many others confirming them, point to a few simple conclusions.

On THIN undercoatings: increasing the thickness of crack-free chromium affords additional protection, and thickness for thickness the chromium provides much more protection than the nickel.

On THIN undercoatings: protection afforded by conventional, cracked chromium increases with thickness up to about 0.02 mil and then falls off again, presumably because the development of the cracks exposes the undercoat, or the stresses caused by the cracking cause similar cracks in the nickel.

On HEAVY undercoatings (about 1.5 mil or more of ductile nickel) protection provided by the chromium increases with increased thickness regardless of whether the chromium is cracked. The crack pattern which develops in the thicker chromium deposits is considered by some to be only slightly disfiguring, but of course can be eliminated with crack-free chromium. In either case, the dramatically improved performance should be well worthwhile. This conclusion is subject to the limitation that the nickel undercoating must be sufficiently ductile so that the cracks in the chromium do not penetrate it; this suggests that in the future more attention might be paid to ductility as a factor in evaluating the

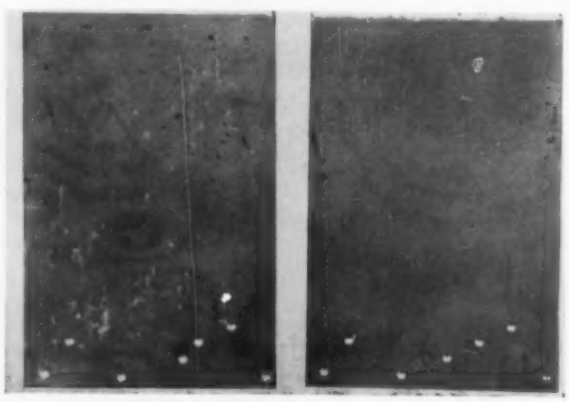

Fig. 9. Effect of thickness of cracked Cr on heavier undercoatings. Cr 0.01 and 0.04 mil over 0.6 mil Cu + 1.4 mil bright Ni on steel. Corrodkote test 28 hours + 4 hours salt spray. (White spots at bottom of panels are holes from identification code.)

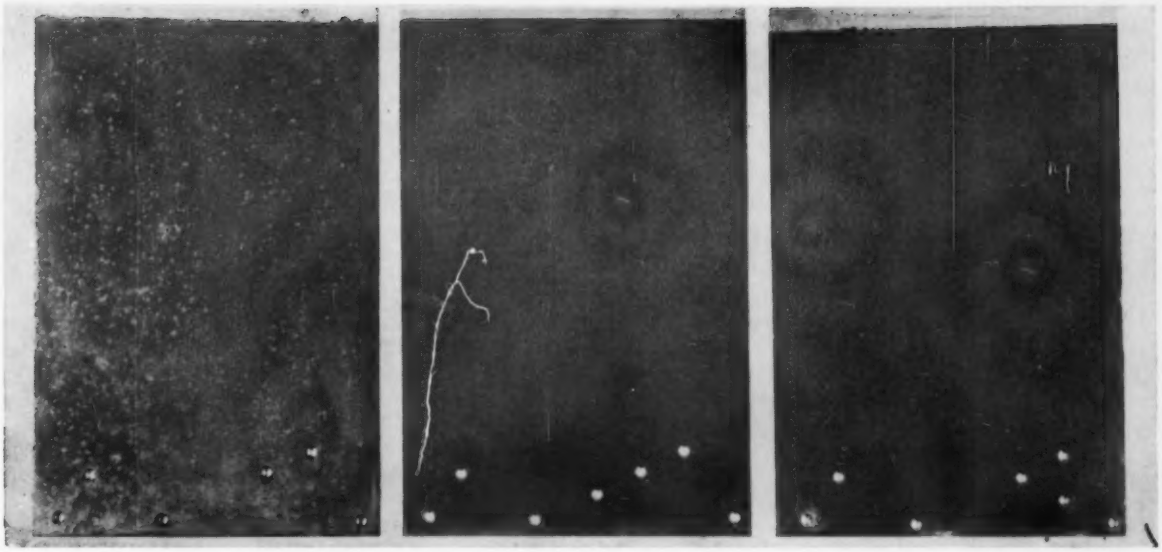

Fig. 10. Effect of thickness of cracked Cr on heavier undercoatings. Cr 0.01, 0.04 and 0.075 mil over 0.6 mil Cu + 1.4 mil bright Ni on steel. Outdoors, Detroit, 1 year. (White spots at bottom of panels are holes from identification code.)

various bright nickels, and to improved maintenance of solutions to ensure maximum ductility of the deposits.

How to Plate Thicker Chromium

There are several approaches to obtaining thicker chromium deposits practically.

(1) Increased plating time. This will produce thicker chromium but in many cases will slow down production unless appropriate alterations in equipment are made.

Chromium can be plated over chromium with the SRHS system, because of its improved activating properties. This permits adding another chromium plating tank to the line, either by extending it or converting a drag-out rinse. Similar techniques can be used for salvaging rejects.

(2) Use of high speed baths and higher current efficiencies.

(3) Better plate distribution. Greater thickness in recesses is obtainable from baths with improved throwing power.

(4) Increased current density.

CONCLUSION

It is becoming quite clear that the corrosion resistance of nickel-chromium (or copper-nickel-chromium) deposits on either steel or zinc-base die castings can be substantially improved by increasing the thickness of the final chromium plate (both cracked and crack-free) considerably above the 0.01 and 0.02 mil heretofore regarded as standard. Although this involves some problems and assumes good plating practice, it appears to be among the most promising approaches to the long-sought goal of better performance of decorative-protective plating.

For practical reasons, the trade will no doubt have to adopt these heavier chromium deposits in at least two steps. First, it may specify a minimum, on significant surfaces, of about 0.03 mil. Other areas will then be much more heavily plated, the average thickness being perhaps 0.05 to 0.1 mil.

Later, as equipment becomes available, the real goal of 0.1 mil or more of chromium on significant areas may be specified. This should go far in achieving the quality and durability of bright finishes for which everyone hopes.

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PLATING—

YESTERDAY, TODAY and TOMORROW

by

A. KENNETH GRAHAM*

PROFOUND CHANGES IN THE ART OF ELECTROPLATING led to the development of a multi-million-dollar industry. Its 30-odd years of growth, starting in the middle twenties and continuing through the period following World War II, has been featured by many highly technical advances in both science and engineering. Today, however, a large segment of the industry appears to be at a crossroad. This is not necessarily due to the temporary business recession, nor is it caused so much by the challenge of new materials, as by the industry's own shortcomings. The decorative-protective segment of the industry is on trial today, more quality-wise than cost-wise. What steps are taken now to overcome these shortcomings can determine the status of the industry tomorrow. Let us therefore explore briefly what might be done.

*President, Graham, Savage & Associates, Inc., Jenkintown, Pennsylvania.

Paper presented on Friday, December 5, 1958 at the Annual Technical Session of the Detroit Branch, AES, Detroit, Michigan.

PLATING—YESTERDAY

To better understand today's position, it is necessary to first briefly review the facts of yesterday.

Many technical and economic factors contributed to the growth and development of the plating industry from 1920 to date.

1. Development of the Watts-type nickel bath and higher speed nickel plating processes.

2. Introduction of Fink's chromium plating process, and subsequent bright nickel processes.

3. Purification and filtration of plating baths and development of high purity plating chemicals and anodes.

4. Development of specifications for plating and their adoption by industry.

5. Large-scale adoption of decorative-protective plated finishes for manufactured products, especially automobiles.

These are but a few of the more important factors—and you can undoubtedly think of many others—which contributed to the growth of the industry.

As a measure of the industry's growth, one might cite two examples:

1. Zinc used in die castings rose from 13,000 tons in 1925 to 405,000 tons in 1955. It is estimated that about 50 per cent of the die castings produced were plated.

2. Nickel consumption in the plating industry rose from 2.8-million pounds in 1926 to 34.1-million pounds in 1956 and is believed to have further increased in 1957.

Dr. William Blum has estimated the total value of the plating industry at 400-million dollars annually, of which approximately 70 per cent or 250-million dollars represents the cost of plating in the automobile industry alone, which for the most part involves decorative-protective application.

Due to the technical and economic factors already mentioned, and especially the development and adoption of

plating specifications, the quality of plated products improved greatly. This is true of zinc and cadmium protective coating applications and steel mill products, such as electrogalvanized strip and wire and electro-tin plate. The quality of decorative-protective coatings of copper and/or nickel-chromium as applied to zinc die castings and ferrous basis metal products also improved initially, but curtailment in the use of nickel in 1941 due to World War II and the subsequent shortages had adverse effects. Coating thicknesses were reduced, copper was substituted for nickel thickness to a greater degree, full bright nickel coatings were substituted for buffable types in many cases, and failure to meet minimum thickness specifications was generally disregarded by both producer and consumer.

The situation was further complicated by the large increase in production of automobiles in the post war period, the greater number of parts requiring decorative-protective coatings, and the increased area and complexity of design of many parts, especially bumpers and grilles. All of these increased the demand for nickel without regard to its availability. Also, manufacturers contracted to produce so many parts at a price on a given schedule, and then stretched the available nickel, supplementing with copper in many cases, to get out production. This necessitated a lowering of specifications which even then could not be met in many cases.

The unfortunate consequence of all this was the premature failure of the bright chrome finishes in outdoor service, especially the bumpers, guards, grilles, trim and door handles of automobiles. This led to questioning as to the ability to produce serviceable plated coatings of the decorative-protective type. It also opened the door to serious competition with other materials and finishes.

PLATING—TODAY

What are the facts today?

Improvement in the quality of decorative-protective coatings is still the most important requirement. Without high standards of quality, plating cannot retain its appeal or maintain a competitive position. Without quality, comparative costs mean little or nothing.

The nickel shortages appear to be over. Increased attention is being paid to the relationship between design of a part and metal distribution. Thickness specifications have been increased. Quality specifications are being more conscientiously enforced. However, the protective value of bright nickel coatings under chromium leaves much to be desired and duplex nickel coating systems are being promoted as one means of improving corrosion resistance.

Producers of plated parts now are being asked to pass more severe accelerated tests than formerly and it is doubtful that there are any who have not experienced difficulty.

Indications are that heavier chromium deposits, especially of the so-called crack-free type, will give improved corrosion resistance for decorative-protective applications. While this may offer some advantage, it is hardly the answer to the deficiencies cited in the use of the copper and/or nickel coatings.

In contrast with decorative-protective coating applications, Watts-type nickel coatings are being successfully used—with or without buffing, in single or double coatings, and with or without chromium—in many applications requiring a high degree of corrosion resistance. A few examples may be cited:

1. Plating of A. E. C. equipment for chemical resistance and purity of product.[1]

2. Plating of diesel cylinder liners to prevent cavitation and corrosion.

3. Plating of large drums for continuously casting plastic films where both chemical and scratch resistance are important.

4. The plating of valve parts for corrosion resistance in certain Naval applications.

However, success can only be attained in such cases by controlling the operations so as to meet the specifications for adhesion, porosity, thickness and purity of the nickel coating employed.

There are also many other present-day examples of successfully meeting specifications with plated coatings other than nickel. All certified plating to Army, Navy and Air Force specifications falls in this classification. This would include hard and porous chromium, cadmium, zinc and other coatings. The remarkable uniformity of thickness and porosity control attained in the continuous production of electro-tin plate is another excellent example.

One would therefore conclude that the poor quality of decorative-protective coatings for outdoor service as currently produced may largely be due to inadequate specifications, including the kind of nickel coating specified in certain cases, and/or failure to meet the specification. The idea that we do not know how to produce high quality coatings of this type is untenable. Just agreeing with these statements unfortunately does not solve the problems.

The following suggestions therefore are made for improving the quality of these coatings:

1. Specifications for plated products should be improved, if necessary, in order to obtain the desired quality. The manufacturers are moving in this direction.

2. Efforts should be continued to obtain a substitute for the salt spray test, with the objective of standardizing on one accelerated test, preferably related to service life, as quickly as possible. This will facilitate both enforcement and compliance with respect to plating specifications.

3. If the need for uniform test panels continues to delay the latter accomplishment, the necessary steps should be taken to get them. The same procedures used in the preparation of panels for Program 1 of ASTM Committee B-8 are believed to be adequate for this purpose. Details of the procedures followed will be published soon.

4. The specified method for measuring thickness should be improved. It has been shown[2] that agreement between different individuals in thickness determinations by the currently standard microscope method may vary as much as 30 to 50 per cent for values of 0.5 mils or less. The magnetic method, such as the magne gage, loses sensitivity at coating thicknesses of 1.5 mil and above and failure to eliminate magnetism in plated steel parts introduces further variations. The chemical method of determining thickness has been

recommended as the more reproducible. It should be noted that Committee B-8 of ASTM is studying this matter.

5. The design of parts requiring plating should be modified in order to favor metal distribution wherever necessary. This should be done at the designing stage. Not to do so only adds to the cost, increases rejects, discourages conformance to specifications, and frequently necessitates compromises with respect to thickness that lowers quality. Furthermore, it is not always possible to correct for faulty design by the method of racking or by the use of auxiliary anodes or intermediate electrodes. The latter features are costly and frequently impractical.

6. Specifications should be developed for the purity and quality of the common basis metals—ferrous, zinc and aluminum base alloys—in particular. The purity and cleanliness of ferrous alloys varies widely. The purity of zinc and aluminum alloys is much more closely controlled. However, defects in zinc and aluminum die castings as received for plating are much too common. Porosity, segregated inclusions and surface defects resulting from inadequate control of casting conditions and/or poor die maintenance are a common cause of failure after plating. Quality plating cannot compensate for defective castings. A rigid inspection of die castings after surface finishing prior to plating has proven effective in eliminating rejects after plating due to the castings. Returning as high as 40 per cent of the castings as defective in one case, and at no cost to the plater, provided a powerful incentive for improvement.

7. More attention should be paid to evaluating and improving the preparatory cleaning cycle as a means of improving quality. Porosity, roughness and adhesion are all influenced by the preparatory cleaning cycle. Quite often a cleaning cycle is a matter of expediency. It may be based on the automatic machine or tank arrangement available rather than what it takes to produce quality.

8. Efforts should be continued to improve the corrosion resistance of the nickel coating used in decorative-protective applications. This might be accomplished by improving the addition agents used in proprietary processes, by using two or more layers of nickel, or even by buffing or brushing an undercoat of nickel. The last two expedients have already proven of value.

9. The benefits to be derived from the use of thicker chromium coatings, both of the conventional type and so-called crack-free type should be further evaluated.

10. A more conscientious, as well as realistic, interpretation and enforcement of plating specifications on the part of both producer and consumer should be an objective. In other words, the philosophy of getting out production regardless of quality specifications, which developed during the periods of nickel shortage. should now be discontinued. In fact, a return to the former type of control when a production line could be shut down by quality control would quickly bring these matters into proper focus where the need exists.

There may be questions about the effect upon costs of applying these suggestions. Ample experience in plating products to rigid specifications proves that quality can be obtained without financial loss—provided, of course, that the price negotiations initially are based on what it takes to meet the specification.

11. Depression bidding at prices calculated in advance to break even or possibly risk a loss is not the most favorable atmosphere in which to accomplish improvement. If improved quality is sincerely desired, such practices should be discouraged by both producer and consumer.

12. Great care should be exercised in placing contracts. Plating contracts should not be let to any establishment that does not have adequate facilities. Specifications can not be met otherwise. Limited tank capacity, insufficient tank voltage and inadequate current capacity are common causes of low coating thickness. Metal distribution suffers when tanks are too small and when racks are badly designed or poorly insulated. Corrosion resistance is lowered when filtration and purification equipment is inadequate. Quality further suffers when the laboratory testing equipment required for proper control is unavailable. And quality can not be met with faulty plating cycles.

Even with adequate facilities quality may suffer because of failure to operate and control properly.

13. Plating for eye appeal alone or just to sell a product should not be tolerated. Such practices do the plating industry great harm. The effort of Committee B-8 of ASTM to establish a quality marking procedure for grades of plating should be expedited. Such a standard should help combat these practices.

PLATING—TOMORROW

And what of plating tomorrow?

The health of the industry as a whole might be expected to improve with an up-turn in our economy, especially if accompanied by an increase in automobile production.

In addition, special engineering and corrosion resistant applications of plating—especially nickel—would be expected to increase. The use of zinc, cadmium and tin for protective coatings should continue as in the past. The use of hard and porous chromium coatings should increase. The use of heavier chromium for the final coating over copper and/or nickel for decorative-protective applications may also increase and with more nickel available, the use of copper would be expected to decline to some extent. However, many decorative-protective plating applications will be expected to decline unless quality can be improved sufficiently to maintain a favorable competitive position. This is such an important part of our industry as a whole that failure to accomplish an improvement would be serious indeed.

Much of what has been said here concerns management, but the plating engineer plays a most important role. It is he who must properly advise what constitutes the adequate facilities which management must provide and without which it would be impossible to meet production schedules and specifications simultaneously. How he uses these facilities and controls the operations will then determine the quality of the plated products produced.

In conclusion, the decorative-protective area of plating —the area of which every automobile owner is most aware —is on trial today because of the industry's own shortcomings. This is more quality-wise than cost-wise and the responsibility for doing something constructive about it must be shared by producer and consumer alike.

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Dr. A. Kenneth Graham has been president of Graham, Savage & Associates, Inc. of Kalamazoo, Michigan and Jenkintown, Pennsylvania, since it was formed in 1944. This organization is well known for its consulting, engineering, research and development services in the electrochemical field. Dr. Graham received BS, ChE, MS and PhD degrees from the University of Pennsylvania where he taught chemistry and chemical engineering for 14 years. He served as consultant to the War Production Board and the Manhattan Project during World War II. He is a member of a number of scientific societies and was executive secretary of the American Electroplaters' Society for six years. He has published many technical articles, holds several patents, and served as editor in chief of the Electroplating Engineering Handbook, which bears his name.

PLATING—
YESTERDAY, TODAY and TOMORROW

Discussion by
DONALD M. BIGGE

Managing Engineer
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Following Presentation of the paper to
AES Detroit Branch, December 5, 1958

I wish to make a few comments on the paper presented by Dr. Graham.

Before making these comments, I wish to state that Dr. Graham has well covered the factors which relate to quality of decorative-protective coatings and I feel that his paper deserves careful study by all those interested in this matter. He is to be thanked for the time required to prepare this paper and for the careful and sound thinking that has gone into it.

I am sure most of us realize the effect on service performance of parts inadequately protected against corrosion. The service performance of parts plated to the emergency specifications during the early 1950's was far below that of parts plated prior to this period or to those parts plated to the regular specifications which were re-instated at the end of this period of allocation of nickel.

Surveys of plated parts on automobiles built during the period when nickel was allocated definitely showed the inadequacy of these temporary specifications. We won't quote rating numbers because the difference between parts plated prior to the period of allocation, during the period of allocation, and subsequent to this period, when compared by length of service, was too great. Many parts plated to the emergency specifications had rating numbers after one year's use which are lower than the rating numbers we now find after three or four years of service.

We do not wish to imply that we are completely over our problems. Many of the parts plated to the emergency specifications were unacceptable to many car owners. These people expect something better and should have it.

We are making progress and I believe are just reaching the point where careful processing under good technical control will produce plated parts of acceptable performance. However, this is not enough. The plating industry is capable of doing better. To do better only means the intelligent use of good processes, properly applied and to the proper specifications.

The technical personnel in the plating plants can assist greatly in obtaining this improved quality. It is something that can be obtained without extra cost. The elimination of a large number of rejections, creation of customer good will, and further expansion of volume of business based upon good performance are all benefits to be obtained by producing good quality parts. These benefits cannot be considered as anything but desirable and necessary to sound business operations.

Dr. Graham has made several suggestions for improving the quality of plated coatings. I believe everyone is attempting to make improvements in the quality of these plated coatings. To do this intelligently, much testing and development work is required. The suppliers of processes are all active in conducting investigations on this matter. Large users of plated parts are also carrying on extensive programs to evaluate the new processes and to help, by their suggestions, in obtaining further improvement. Technical societies, such as the American Society for Testing Materials, the American Electroplaters' Society and the Society of Automotive Engineers are all contributing to the store of knowledge on this matter and this combined effort will produce the answers needed to firmly establish proper specifications, better methods of predicting service performance and, I hope, uniformity of specifications within an industry. This will work to the benefit of the plating companies as less flexibility will be required in variety of solutions, type of plating equipment, and other operating factors.

The producers of automatic plating equipment will benefit by soundly established, industry accepted specifications as they can use these specifications as a basis for design of equipment.

The industry will benefit by the use of these specifications as it will bring about an increase in quality by use of good processes, applied to sound specifications by equipment designed for these specifications.

Much work remains to be completed before all these benefits can be obtained. The combined effort of everyone interested in electroplating is necessary to obtain at the earliest moment all information required to establish such specifications and use them in production.

This can be done, and will be done.

The paper presented by Dr. Graham lists all these things and to further increase the use of plated parts, the thinking and action of all electroplaters must be directed toward improvement in service performance.

Abstracts of Papers Presented at the

ALL UNION SCIENTIFIC / TECHNICAL CONFERENCE ON CORROSION AND PROTECTION OF METALS

Metal Coatings and Chemical Treatment Sections, and Lacquer Coatings Section

MOSCOW, USSR, MAY 19-24, 1958

Part I

Dr. Abner Brenner, National Bureau of Standards, Washington, D. C. attended this conference and his report was published in the October 1958 issue of PLATING. These abstracts were obtained by Dr. Brenner and are used in PLATING through his courtesy*.

I. DEGREASING AND ETCHING OF METALS

CHEMICAL AND ELECTROCHEMICAL CLEANING OF METALS

(Classification of processes, state of work in the last year, industrial utilization, perspective of the development of methods)

by P. P. Belyev and P. A. Galaktionov

I. Degreasing

1. The difficulty arising from oxidation by burning which occurs when using temperatures of more than 350C.

2. The utilization of organic solvents requires the use of unhealthful and inflammable material.

3. Removal of oily impurities with aqueous emulsions permits the avoidance of these difficulties.

4. Electrochemical degreasing with dc permits the acceleration of the process of cleaning, but it involves the evolution of hydrogen which in some cases has a high explosive danger; using ac does not have this deficiency and permits a supplementary speedup of the process of degreasing by introduction of emulsifiers.

5. Degreasing by ultrasonics is a rational approach for fine threaded details and pieces having openings of small diameter, and also for purification of non-electrical conducting parts.

II. Removal of Oxides

1. The difficulty of cleaning from oxides by reducing in a gaseous medium occurs at temperatures of 700C and above.

Treatment with burners is used for coarse surfaces (casings of ships, pillars, etc.).

2. Reduction of oxides on steel pieces by sodium hydride requires temperatures about 350C and there is also fire danger because of the presence of easily flammable metallic sodium used as the starting material.

3. Jet cleaning of steel from oxides is 3-5 times as effective in scouring as a stationary bath, and it significantly reduces the difficulties and cost of treatment.

4. Electrochemical etching with ac has an advantage over treatment with dc as a consequence of decreased hydrogen embrittlement of the work.

III. Improvement of the Process of Degreasing and Etching.

1. Introduction into solution of wetting agents, complex formers, inhibitors (OP-7; OP-10; Trilon B and others) significantly improves the process of cleaning.

2. Jet cleaning along with increased effectiveness of treatment simplifies the mechanization of the process and creates normally sanitary conditions for work on parts in their preparation under the protective coating.

3. Improvement of the process is attained also by introduction of oxidizers.

4. In production there is a wide distribution of the process of simultaneous jet degreasing and etching.

5. Linking the degreasing and etching operations reduces the number of technical operations for cleaning of metals and also the required space for production.

6. Using a pulsing jet of liquid improves the process of purification twofold as compared to the use of a laminar jet.

7. Use of electrohydraulic treatment permits a significant increase in the rate of purification and elimination of slag on treatment of bars with this set-up.

IV. Securing a Firm Link Between the Outer Coating and the Base

1. The magnitude of the operation of inhibition is involved in the creation of inertness of the surface to the subsequent coating.

2. A characteristic of the preparation includes the creation of a semipermeable passive film which requires an unnecessarily deep etching or mechanical treatment for improving the surface.

V. Regeneration of Reagents

1. The most satisfactory procedure for removing mechanical impurities from solutions is that of separation.

2. Utilization of etching solutions to obtain vitriol is not economical. A better expedient is the use of electrolysis and thermal decomposition of volatile compounds.

3. An effective process of freeing the electrolyte of harmful impurities and regeneration of the electrolyte is obtained by using ion exchange resins.

VI. Characteristics of the Constructed Set-Up

1. Jet treatment simplifies mechanization of the process and of mounting a set-up into the production line rather than separating it in an isolated place.

2. Combining degreasing and etching in one technological operation reduces the required space used for the set-up with jet cleaning.

3. Introduction of cleaning by pulsing jet is hampered by the absence of simple apparatus for creating a pulsing liquid.

4. Use of electrohydraulic treatment for cleaning metals is slowed up because of the absence of suitably constructed apparatus for using the process.

TECHNOLOGICAL PROCESS OF SIMULTANEOUS JET DEGREASING AND ETCHING

by P. A. Galaktionov, L. F. Dribin and M. V. Sardanovski

Combining the operation of degreasing and etching reduces the number of technological operations in cleaning metals, and also the required working space.

In foreign procedures the combining of the operations of degreasing and etching in preparing metals before painting is found to be widely practiced.

The basic components of the composition for simultaneous degreasing and etching are organic solvents, acids and emulsifiers.

The compositions may be used for cleaning in stationary baths and also with jet methods.

Set-ups are possible to simultaneously degrease and etch with compositions without solvents, but with rapid loss of degreasing capacity of the solution, on the basis of acids and emulsifiers, but foaming difficulties are involved in these with jet methods of cleaning.

For normal work with a jet set-up it is necessary to constantly maintain the concentration of solvent to not less than 20 ml per liter of composition.

For industrial use the following composition is recommended for simultaneous degreasing and etching.

Sulfuric or hydrochloric acid	50–250 g/l
Solvent	20–250 ml
Emulsifier	3–8 g/l
Thiourea	3–5 g/l

The temperature of the solution is 20–60C. Cleaning is continued 3–5 min.

The relationship of acid and solvent varies depending on the degree of greasiness and corrosion danger to the metal.

Experiments combining three operations; degreasing, etching and corrosion inhibition—using solutions based on phosphoric acid gave negative results, but by using acids with concentrations necessary for etching, deposits of iron phosphate do not occur on the surface of the metal.

It is established that corrosion inhibition is attained where after simultaneous degreasing and etching in solutions based on phosphoric acid, the metal is dried without rinsing; but on immediate application of lacquer coatings the film becomes defective.

It is recommended that after degreasing and etching there be used before painting a corrosion inhibitor in hot solution, containing 0.5 per cent chromic acid, and 0.5 per cent phosphoric acid, then dried without rinsing.

Simultaneous degreasing and etching solutions based on phosphoric acid are expedient for detailed work, having solid connections, and also where the jet cleaning is set up in a small space. The scheme of the process is the following: cleaning 3.0 min; rinsing 0.5 min; corrosion inhibition 1.0 min; drying 4.0 min.

DEGREASING OF STEEL IN AQUEOUS ALKALINE SOLUTIONS

by M. J. Morchov, K. A. Egorova and G. V. Filimonova

We investigated the detergency of aqueous alkaline solutions of sodium carbonate and silicate and trisodium phosphate in the presence of surface active substances OP-7 and OP-10—and without them—for the removal of mineral and vegetable oil, and polishing paste from the surface of steel.

Procedures for the separation of these oils were directed chiefly toward dispersing them by means of emulsifiers or suspensors. Dispersing of oils is

* Translated by Leonard Shapiro, Silver Springs, Maryland.

accomplished with mechanical procedures by placing them into a solution and agitating them in a mixer or by ultrasonic vibrations.

It was established that the detergency of the solutions indicated, depends on the composition, the mechanical force of the action, temperature, and the nature of the oil.

The best detergent was found to be a solution of trisodium phosphate, the solutions of sodium silicate and carbonate were somewhat poorer and caustic soda was very bad.

Surface active substances OP-7 and OP-10 significantly increased the detergency of the indicated solutions, more by agitating in an agitator and less by agitation with an ultrasonic vibrator. The ultrasonic vibration method proceeds to disperse oils sufficiently rapidly even in the absence of OP-7 or OP-10, which occurs very slowly on agitating the solution in an agitator. But there forms, in the absence of a surface active substance, an emulsion which quickly decomposes, the oil floats on the surface of the solution and again greases the steel from which it was removed.

The greatest difference between the force of the mechanical action needed and the speeds of dispersion for different oils is in the region of temperatures at 25C. Above this these differences abruptly decrease and at 70–80C become insignificant. Such phenomena is apparently connected with the decreased viscosity of the oil, which at 70–80C becomes approximately similar, and consequently the oil requires a similar mechanical force for dispersion. However, with this force of mechanical action, the impinging of the solution on it by the agitation of the agitator, there is removed from the surface of the steel the oils, the organic components of the polishing paste, and only part of its abrasive. Part of the abrasive remains on the surface of the steel. (Analagous phenomena is found also on removing the pastes with organic solvents). More force of mechanical action, caused by ultrasonics, is instrumental in removing abrasives fully from the surface of the steel.

With complex profiled parts of objects to be cleaned, the mechanical action of the mixing in solution in an agitator or ultrasonic vibrator becomes weakened. Therefore, such parts are freed from impurities at a slower rate than parts well available to the mechanical action.

However, in water solutions of trisodium phosphate and OP-7 or OP-10, by agitating in an agitator long enough to remove oil from the surface of the steel objects with a liquid flow at room temperature, the length of time does not differ sharply from separations with organic solvents. Heavy oil, grease and polishing paste are removed by this solution significantly slower than with organic solvents.

The indicated greases are removed by the abovementioned water solution with ultrasonics significantly quicker and better than with organic solvents. However, this method of cleaning, because of the absence of powerful ultrasonic apparatus is currently used only for cleaning small gage complex profiled objects, where other methods of cleaning would give difficulty.

For the indicated purpose we recommend the following solution composition: 10–30 g/l $Na_3PO_4 \cdot 12H_2O$ and 0.5-3 g/l OP-7 or OP-10.

The regime of treatment is as follows:

1. By Agitation of a Solution in an Agitator

1) For removal of oil at room temperature from the surface of steel, a liquid flow at a temperature of 50–70C continued for 0.5–5 min.

2) For removal of heavy oil, grease and polishing paste from the surface of steel, use a temperature of 70–80C continued for 10–90 min.

2. With the Use of Ultrasonics

1) For removing oil at room temperature from the surface of steel a liquid flow at a temperature of 25–50C continued for 5–30 sec.

2) For removing heavy oil, grease and polishing paste from the surface of steel, a temperature of 70–80C continued for 10–60 sec.

ACCELERATION OF THE PROCESS OF DEGREASING, ETCHING AND CLEANING OF METALLIC SURFACES IN AN ACOUSTICAL FIELD

by A. A. Baram and B. A. Arganat

1. A short review is made of ultrasonics for intensification of the process of purification of metallic surfaces in the USSR and its limitations, and the state of such work at the present time.

2. The basic technological advantages and disadvantages of using acoustical transformers in the work of the Leningrad Division "Lacquer Coating."

a) A Piezo quartz ultrasonic set-up makes it possible to obtain high intensity (to tens and hundreds w/cm²) and a range of frequency from 0.2 to 5 Mc/sec, but its industrial use is limited to small sized quartz vibrators which are expensive.

b) Siegnetto electric-barium titanate ceramics have high piezo modulus; i.e., at significantly lower voltage than in the case of quartz we are able to obtain similar strengths of ultrasonic field (for obtaining an intensity of 1 w/cm² at a frequency of 100 kc, the required voltage is 10,000 v for quartz, and 100 v with barium titanate) and to accomplish a focusing of the acoustical vibrations. An unsatisfactory titanium emission is obtained below the Curie point (100–120C).

c) Magnetostriction vibrators do not require high tensions, permitting one to obtain sufficiently large power given off per unit surface, with a high stability and durability, making it possible to work under conditions of wide range of temperatures.

d) Electromagnetic vibrators have a low frequency (100 cycles/sec) and a low intensity but permit sound to cover a large area.

3. The methods used in the work of the Leningrad Division of "Lacquer Coating" to measure the intensity of acoustical vibrations:

a) Calometric procedures (method of Prof. Bkhadra);

b) Water wave probe (developed by the Acoustical Institute of Acad. Sci. USSR).

4. The advantages of using reaction vessels of plastic permit the conduction of sound in chemically corrosive media (acids, alkalis).

5. The influence of acoustical vibrations on the process of degreasing.

Experiments presented by the specified methods showed that ultrasonics was more effective than mechanical agitation (600–900 vol/min) and low frequency vibrations at a frequency of 100 cycles/sec.

For illustration of this the corresponding graphs are given, from which it follows that the process of degreasing under the action of ultrasonics is speeded up by tens and hundreds of times relative to the usual conditions with mechanical agitation. With this, the quality of the cleaning is significantly improved.

6. We studied the influence on the process of degreasing with the acoustical field by currents of different frequency (from 100 cycles/sec to 2 Mc) and intensity (from 0.1 to 8 w/cm²).

We established the existence of optimum frequencies where the lowest intensities produced the maximum effect. We investigated likewise, the influence of the temperatures of the reacting media. We established the existence of optimum temperatures at which are obtained the greatest effects of the action of the acoustical vibrations, and found that for different detergent compositions these optimum temperatures are different.

There is an influence on the intensity of the process of degreasing depending on the composition of the detergent liquid (white spirits, benzene, alkaline solutions, water emulsions).

7. There was recently presented the mechanism of the acceleration action of acoustical vibrations in the process of degreasing, the influence of the vibrations and the effect of the clap of the cavitation bubbles, the effectiveness of cavitation phenomena in dependence on temperature, and so on.

8. We investigated the process of etching the scales and rust on exposure in acid baths to acoustical vibrations.

It was experimentally presented at the Leningrad Division of "Lacquer Coating" specified methods that ultrasonics speeds up the process of etching by tens of times relative to the usual procedure with mechanical agitation.

9. The influence on the process of etching of rust and scale in an acoustical field:

a) The frequencies (from 100 cycles/sec to 2 Mc) and intensities (from 0.1 to 8 w/cm²) of acoustical vibrations.

Some parameters were established for which with less consumption of electrical energy, a maximum intensity of the process can be obtained;

b) The composition and concentration of acid baths. It was established that for the action of an intense acoustical vibration, the change in the concentration of acid in the range 30–50 per cent is not noticeable on continued etching, consequently this opens up the possibility of reducing the outlay of acid with ultrasonic etching by 30–50 per cent.

c) The temperature of acid baths has less influence on the course of the process than that on etching without ultrasonics.

10. We studied the influence of ultrasonics on some physical-chemical parameters (electrode potential, chemical equilibria) and examined the mechanism of etching in the acoustical field.

11. The action of the acoustical vibrations on the process of removing scale from metallic objects. The consequent intensification of the process in the acoustical field makes it possible to mechanize this operation as it is often done manually in production.

12. There are advantages and disadvantages to ultrasonics for intensification of the process of degreasing, etching, and cleaning metallic surfaces, and to its application in industry.

ULTRASONIC DEGREASING

V. M. Gevorkyan

In some applications by industry of ultrasonic set-ups for cleaning objects, the working liquids are the organic solvents—trichlorethylene, acetone, etc.

For convenience and economy in the technological process of degreasing we used as a working liquid the common supply line water.

For a source of ultrasonic vibration we took the magnetostriction transformer (vibrators) prepared from alloys of Permendior or from nickel. In particular we used a vibrator of Echolota with conducting coils BPVL of cross section 2.5mm with 14-15 turns on two end sections and 16-17 turns on two middle sections connection to the end sections.

A series of experiments established the optimum conditions for degreasing. From this it was shown:

a) The most effective degreasing was attained at temperatures of water of 70 ± 5C.

b) The most effective degreasing was attained using a vibrator with a natural frequency of 16–20 kc with the same frequency as the source of current.

c) The closer the surface of the emitter for treatment of the piece, the more intensive is the process of degreasing.

d) The acoustical density of vibration for degreasing is found in the range 5-5.5 w/cm² from the radiating surface.

On the basis of the presented investigation we prepared a working model of a conveyor set up for ultrasonic degreasing of steel strips of widths to 50 mm and thicknesses to 0.35 mm.

Degreasing was done in baths of 100 l with 4-5 changes of hot water per hour in two vibrators.

The rate of degreasing attained 20 M per minute which corresponds to a time of degreasing in the zone of cavitation of 0.5 sec at a distance of 1 mm from the vibrator.

II. PHOSPHATE COATINGS ON THE MECHANISM OF FORMATION OF PHOSPHATE COATINGS ON METALS

by V. S. Lapatuchin

1. The process of phosphatization is used very widely in industry, not only for heavy metals but also for many light ones: zinc, aluminum, magnesium, tin and others.

2. These processes were developed toward improvement of methods to obtain the properties of general phosphate coatings, having relatively large thickness, but also to obtain better methods of thin layered phosphatization, for which special phosphating solutions are used.

3. We conducted investigations to show that the introduction into the solution of different additives, or applying currents, affects the character of the process and produces along with it significant changes in the properties of the phosphate coatings: protective and absorption properties, color and mechanical stability (durability), thickness of coating, etc. The mechanism for all of these changes has as yet been studied only slightly.

4. The process of cold phosphatization of metals is quite insufficiently investigated. For this reason the use in practice, of solutions for cold phosphatization and methods of treatment of objects is not always sufficiently effective. This detracts not only from cold phosphatization of heavy metals, but also from the nature of phosphatization of light metals, phosphatization by current, etc. The mechanism of formation of phosphate coatings is quite insufficiently studied: Known works in this area rest in many cases on weak experimental bases, often in contradiction one with the other, and finally do not reveal the nature of the phenomena, or specify the properties of the coatings.

5. For an extremely long time a widely accepted view has been held that the process of phosphatization occurs in two steps. The reasons for the development of coatings in two steps of the process show a difference in point of view.

6. A. Viostefeldom from beyond the border and I. V. Krotovim in the USSR have described a colloidal-electrostatic mechanism of formation of coatings.

7. An electrochemical theory of phosphatization in developed in the works of V. I. Wolfson, V. Machu, K. Kovacha and others. The authors treat differently the nature of the electron process developed by interaction of the metal with the phosphating solution and interpret differently the same mechanism of formation of phosphate coatings, and also the role which the accelerator plays.

8. In our investigations we did not answer the problem of the many-sided study of phosphate coatings which occurs in the multiform methods and solutions used for this purpose. We studied branches of the problem connected chiefly with the explanation of the nature of certain phenomena developed in cold phosphatization of dark and light metals; in order to explain the influence on these processes of the activating additive and the applied current.

9. Parallel to the investigations of the change in weight of the sample, and content of ions of the treated metal in phosphate solutions containing some additives (sodium fluoride and nitrite or sodium or zinc nitrate) we developed a specific rule of change in the speed of solution of metal ions in dependence on the concentration of these additives. We generally clarified the specific nature of action of the activating addition and specificity in behavior of different metals in solution with different additives.

10. The electrochemical behavior of different metals in these solutions on applying direct current is also specific. We showed that higher concentrations of additive caused a decrease in overvoltage of hydrogen, on enabling us to obtain a good coating in a relatively short period of time.

11. We studied the process of forming a coating in cold phosphating solutions by current, allowing us to develop a series of important rules and to characterize the specific features of the action of

changing and direct current with cathodic phosphatization of metals.

12. As a result of the conducted investigations, it was established that to govern the process of phosphatization one may change the speed, as an anodic or as a cathodic reaction. This may be attained by introduction into solution of special additives, changing the acidity of solution, and the use of polarization by external sources of current.

A NEW OXIDOPHOSPHATE COATING FOR STEEL PARTS

by A. F. Krutikov

1. The development of a new process of anticorrosion treatment consists of the common process of oxidation and subsequently a phosphatization.

By such a treatment there occurs a filling up of the pores of the oxide coating by phosphate, and creating a supplementary thin phosphate coat next to the oxide coat. Thanks to this there is created a fine outer appearance of the coating (a deep black color) and a relatively greater increase in protective properties.

A comparative test of the new coatings as regards length of storage under warehouse conditions shows it to be advantageous compared to an alkaline oxide coating.

Oxidophosphate coatings do not lower the longevity of the piece and thanks to a lowered coefficient of friction the moving piece is easier to treat automatically.

With phosphate corrosion inhibition of cadmium plated and chrome plated parts and also with zinc plating or zinc plating followed by oxidizing (to produce a black color) the parts are increased in their protective properties.

2. There was developed also a new method of inhibition of steel in place of inhibition by salts of chromic acid, trisodium phosphate, and other salts.

Phosphate inhibition consists of treatment of the steel part in solutions of the phosphate salt with high concentrations of oxidizer at relatively low temperature and short exposure.

With such treatment there is created on the steel surface a thin and firm film with high protective properties.

After introducing phosphate inhibition into production, the period of time of storability of the object was increased 2–4 times.

Phosphate inhibition does not decrease the longevity of the piece, a number of springs of wire of high stability were treated with it and also gave improved properties of working of the springs as the result of a decreased coefficient of friction.

The new coat has an advantage for treatment in large scale technology, especially for use under atmospheric conditions.

A difference in phosphate inhibition here from known methods of phosphatization is this, that with this treatment there is a complete absence of hydrogenation and ulceration of the surface of the piece especially with springs.

This permitted the use of the indicated form of phosphatization for treatment of springs (from wire of high stability) with high load carrying capacity apart from the so-called "white" parts of objects.

3. The developed new process of phosphatization consists of a sequence of treatments in two solutions of different composition. In the first phosphating solution a black undercoating is applied, and in the second solution there occurs a filling up of the pores of the first coat by an overlay of the second layer of the phosphate of the other metal.

Thanks to such a double treatment there is created a coat of dark color with increased (compared to other known phosphate coatings) protective properties.

Comparative experiments of the new combined coating in corrosion media showed better corrosion resistance of the new coatings relative to the resistance of other forms of known phosphate coatings.

The new coating did not decrease elongation of the piece and improved the workability for automatic handling.

4. We conducted investigations of the influence of the new coatings on the reduction of the ductility of the sample by alternately jerking and bending a wire, and also experiments on the total longevity of the work piece.

Phosphate inhibition in all cases did not decrease the number of bendings of the wire required for destruction or the durability of the wire on alternate jerkings.

Experimentation established that the new coatings did not decrease the longevity of the work piece.

5. We developed a new method of preservation consisting of treatment of the work piece by phosphatization, instead of by a thick oily layer, using water repellant liquid GKSh-94 in small concentrations.

6. We developed also a new procedure of packing up in which is used two seamless casings of special cellophane (with dry air), and in this manner we created a dependable hermetic packing.

The new method of preservation and packing, in connection with coatings with increased protective properties permit increased periods of storage by 5–10 times; moreover, it sharply decreased the time needed for treating the piece prior to its use.

The first such methods of preservation and packing were used for special items in the course of 12 years of storage. Articles after 10–12 years of storage did not have corrosion. Articles removed from cases were prepared and immediately usable, as there was no thick coating of oil on these surfaces.

THE NATURE OF PHOSPHATED STEEL IN THE PRESENCE OF NITRATE SALTS

by I. I. Chain

1. For speeding up the process of phosphatization of metals on the basis of the currently presented description concerning the mechanism of formation of the phosphate film, it was proposed that the most likely is the introduction into solution of oxidizers of the type nitrate salts. But the process of phosphatization with added nitrate salts had not been studied up to this time. The optimum concentrations of salts of this type is not known, and the nature of the process of the formation of the film and its structure is not established.

2. We studied the influence of added nitrate salts of single valent, divalent and trivalent metals on the basis of the factors in the process of phosphatization [acidity of solution, length of time of film formation, weight, color, thickness, microgeometry (structure), corrosion stability of the film and capacity for increased adhesion of lacquer coatings].

The results show that the action on the rate of film formation by nitrate salts may be divided into three groups:

a) No change in the period of time for film formation.

b) A speedup of the process of formation of phosphate films.

c) A slowdown in the process of film formation.

With change in the length of time of film formation there is also a change in all other investigated factors.

3. We observed a difference in the influence shown by nitrates on the process of phosphatization, explained by the difference of capacity of them to hydrolyze with the evolution of nitric acid. A study of the process of phosphatization in the presence of free nitric acid which is formed as a result of hydrolysis of nitrate salts was done to investigate the factors of the process of phosphatization and properties of the phosphate films.

4. A study of the kinetic process of formation of phosphate films showed that the rate of crystallization of phosphate on the surface of the metal depends on the form of the preliminary treatment of the metal and on the composition of the solution for phosphatization. The development of the phosphate film precedes the solution of the base of the metal.

5. The composition of the phosphate film is the secondary and tertiary phosphates. In the presence of zinc nitrate films form, consisting chiefly of the neutral phosphate. The composition of the phosphate film is influenced also by the form of the initial treatment of the metal surface.

6. The capacity of the phosphate film to increase adhesion of the applied lacquered coat depends on the roughness of the surface formed by the phosphate film. With increasing roughness of the phosphate film, adhesion of the lacquered coat at first grows, but thereafter decreases. For equal roughness of a phosphate film and the surface of the metal subjected to sand blasting treatment adherence of the lacquered coat to the phosphate film is significantly stronger, than to the sand blasted surface of the metal.

7. As a result of the investigations conducted, we developed three new methods of protecting the metal from corrosion; speeding up the phosphatization, producing phosphate-oxide films (nonalkaline oxidation) and cold phosphatization.

Speeding up phosphatization was accomplished by a method of immersion in solution of the preparation "Mashev" or monozinc phosphate (30–40 g/l) with added zinc nitrate (50–70 g/l). By this process of phosphatization there was a speedup of 4-5 times (to 10–15 min). Increased concentration of the preparation "Mashev" (to 70–80 g/l) with a simultaneous lowering of the concentration of zinc nitrate (to 20–30 g/l) permitted a lowered working temperature of solution from 96–98C to 60–70C and the obtaining of a phosphate film with increased protective properties (relative to the generally used technology of phosphatization). Speeding up the phosphatization is especially expedient for protecting steel from corrosion, with thin walled parts, thin wires, zinc plated and cadmium plated parts, and also parts from low and middle alloyed, and special (transformer) steel.

From the results of actual experience in four corrosion stations, the decision was adopted for wide introduction into ship construction for all phosphatization and painting of ship parts to use the speeded-up phosphatization in place of the usual methods.

Phosphate-oxide films are smooth, shiny and dark in color. By this protection, the mechanical and adhesion properties excel oxide films, formed in alkaline oxidation (bluing). Technological obtaining of phosphate-oxide films (nonalkaline oxidation) is technically easier than alkaline bluing. Phosphate-oxide films form likewise on zinc and its alloys and effectively protect them from corrosion. For obtaining phosphate-alkaline films, solutions are used containing phosphoric acid (from 8–12 g/l) and nitrates of the alkaline earth metals (from 60–80 g/l).

Cold phosphatization intended for protection from corrosion chiefly of rough objects does not yield to submersion in baths. Procedures here are based on use of solutions of the preparation "Mashev" in increased concentration (100–200 g/l). Comparative tests showed that protective properties obtained by films excels the protective capacity of films formed by existing methods of cold phosphatization. Additional advantages of the method are the absence of subsequent rinsing with water of the phosphated surface, which is extremely important for protection from corrosion of large surfaces. Our procedure is widely used in ship construction and other branches of industry for corrosion protection of rough construction (sections, blocks, underwater parts of the bodies of ships).

PHOSPHATIZATION OF CHROME STEEL AND LIGHT METALS

by M. A. Novitskaya

1. We developed a process of phosphatization of low carbon steel containing 4.5–6.0 per cent chromium and added molybdenum or vanadium (steel 12x5MA and 12x6FA).

This steel needs a protection from corrosion as does carbon steel. The presence of chrome in steel has a negative influence on the process of phosphatization.

It was established that after normalizing and annealing, conducted under ordinary conditions, i.e., in furnaces with non-humidity controlled atmospheres on the surface of objects which are sandblasted or etched there remains some quantity of chromic oxide, worsening the properties of the phosphate film obtained by the common process of phosphatization.

This is found to be in agreement with the proposals of Prof. Archarovim on the fact of enrichment of the surface of the metal just under the scale of an alloying element, having a low rate of diffusion (of metal and scale) at high temperature treatment.

2. For obtaining a good quality phosphate film we introduced a preheating thermal procedure (normalization at 910 to 930C) in an atmosphere of the type CO or CO_2.

By this, it was found that no oxide could be located on the surface and after sand blasting the steel may be phosphatized by the common methods.

3. Phosphatization of the previously mentioned steel is conducted in solutions of zinc monophosphate to which must be added copper in the form, for example, of $CuNO_3$. The quantity of copper must be strictly regulated and controlled analytically, for it will develop special (colorimetric) phosphate films, analogous to those obtained with carbon steel; this has been shown by chemical and x-ray structural analysis.

4. The phosphate film on chrome steels serves as a good base under a lacquer coating. For objects not submitted to the immediate action of an external atmosphere, after phosphatization one may use a treatment with water emulsion of oil TsIATIM-215 with subsequent drying at increased temperature.

Such a type of complex coating protects metals well for storage and warehouse conditions.

5. For phosphatization of zinc and cadmium plated surfaces we used baths of similar composition. The process may be carried out as in the above or also at room temperature. In the latter case, the per cent composition of the bath is somewhat changed. Such a type of treatment may be successfully used instead of chromating (bichromate inhibitor), in particular for the use of coatings on objects to be used near sea air.

Phosphate films obtained in cold baths are of equal value in their protective properties to those obtained from hot baths.

USE OF ION EXCHANGE RESINS IN CHEMICAL AND ELECTROCHEMICAL TREATMENT OF METALS

by E. V. Gannushkina and A. I. Orlova

1. In the last year in electroplating production outside our borders there was a widespread use of ion exchange resins for demineralizing water, purifying electrolytes from poisonous impurities, regeneration of etching solutions and extracting from them expensive components, for purifying all kinds of wash water, discarded into the sewer systems.

2. For this purpose cationic and anionic resins of different sorts were used to clear the solution of acids and oxidizers.

3. The process of ion exchange consists as a rule of a method of filtering the treated solution through a layer of granular resin by gravity or under pressure.

4. Domestic investigations of the problems of ion exchange have not been applied to electroplating processes; there are no industrial set-ups.

5. Our Institute in common with NII Plastics, investigated the possibility of regeneration of solutions of phosphoric acid which would be used in set-ups for simultaneously degreasing and etching parts of tractors and other agricultural machines prior to painting.

The investigations established that the most appropriate for this purpose is cationic resin KU-2.

6. On the basis of investigations it is planned to obtain an ion exchange set-up on which a technological process of regeneration of the above-mentioned solutions could be worked out.

7. At the present time we are conducting investigations for the purpose of selecting a resin and developing a technological process to regenerate chromates and electropolishing electrolytes and to purify rinsing water discarded into the sewers.

III. IMPROVEMENT OF COATING PROCESSES AND WEAR RESISTANCE COATINGS

ON THE MECHANISM OF ELECTRODEPOSITION OF METALS WITH CURRENT OF CHANGING DIRECTION

by A. P. Papkov and A. T. Vagramyan

In the domestic and foreign literature in the last year there have appeared a large number of works, giving methods of electrodeposition of metals with currents which periodically change their direction, so-called reversing currents. Deposits of metals obtained by deposition with currents of changing direction in many cases have a dense finely crystalline structure and superior high corrosion resistance. But the reason for the better quality of electrolytic deposit obtained by these methods mentioned remains unexplained to this time. The reason for this is partly the complexity of the process, but also the absence of suitable methods of investigation. In some works, in studying the electrode processes occurring in short periods the changing direction of polarization current (0.1-1 sec), used the usual compensation methods to take down a polarization curve, the use of which makes it impossible to determine the change in polarization from tables for these short intervals of time.

In order to explain the basic reason instrumental to obtaining the good quality coatings, we used an oscillographic method to record the polarization curves which permit a study of the processes occurring on the electrode during short period changes of direction of the polarization curve.

A study of polarization during the electrodeposition of silver in cyanide solution with current of changing direction suggested the possibility, on the one hand, of a significant increase in the rate of deposition of metals and, on the other hand, of combining the process of electropolarization and deposition from the same electrolyte. The basic factors instrumental in obtaining shiny deposits of silver are the periodic formation on the electrode of silver oxide in a short time when it is the anode material, and then a reduction of the oxide on change in the direction of current.

In the work we also studied the influence of current with changing direction on the number of crystals formed during deposition of silver from nitrate solutions. From this it was discovered that the number of centers of crystallization after an initial brief period while an anode were significantly greater compared to direct current polarization of the silver electrode. This latter explains the activation of the surface of the electrode at the expense mainly of the solution of the sharp points of the fine grain crystals in anodic polarization. On the bases given, we obtain, on taking down the polarization curve and determining the number of crystals on deposition of silver in nitrate solution, the explanation that one of the reasons for better quality electrolytic deposits obtained on deposition of metals with current of changing direction, is the increase in the number of centers of crystallization at the expense of activation of the surface of the electrode on anodic solution of the metal.

THE INFLUENCE OF THE REVERSAL OF CURRENT ON THE INTERNAL STRESS OF THE ELECTRODEPOSITED COATING AND ON THE UNIFORMITY OF THE METAL ON THE CATHODE

by G. T. Bachvalov

1. The nature of the cathodic process on electrodeposition of metals in a reversible current: It reduces the degree of polarization of the electrode, increases the degree of uniformity of the deposit, changes the geometrical form of the crystals, etc.

2. A study of the internal stress of the electrodeposited coating has an essential scientific and practical significance. We presented results of the experimental work on a study of the internal stress of electrodeposited copper obtained from cyanide electrolytes, containing different concentrations of copper cyanide and free cyanide, at different temperatures and current densities. It was established that with increased current density, the internal stress changes differently depending on the temperatures of the electrolyte and its transition through zero. The internal stress is found to linearly depend on the concentration of copper cyanide and had an inverse dependence on the concentration of free cyanide in the electrolyte. This, in all cases, decreased with reversing current.

3. On this basis we explain the cause of the change in internal stress of copper coatings, by its dependence on different factors of the electrolysis state, the influence of these factors on the structure of the deposit and the geometrical form of the crystals. As a rule, the highest internal stress is inherently in that electrodeposit of copper which is most perfect according to structure and density.

4. The internal stress of plated zinc from alkaline-cyanide electrolyte is relatively small and practically independent of current density and temperature.

5. A study of the influence of different factors on internal stress of plated nickel and also on its porosity permits the assumption that internal stress is a maximum in electrodeposits obtained from such current densities which ensure the smallest porosity of the plated layer. With increase of current density, the magnitude of the internal stress of the coatings changes, passing through a maximum. A reversing current under all conditions of electrolysis reduces the internal stress of the layers of plated nickel.

6. We presented experimental data on the influence of the reversing current in the dispersal of metal on the cathode with electrodeposited zinc from alkaline-cyanide electrolyte, and copper and silver from cyanide electrolytes. In all cases, the dispersion capacity of the baths is significantly increased on reversing the current compared to that found with direct current. We gave an explanation of the observed phenomena.

IMPROVEMENT OF THE PROCESS OF CHROME PLATING

by M. A. Shluger and A. Ya. Ryaboy

We examined the experimental material concerning the electrodeposition of chromium from two electrolytes: self-regulating and tetrachromate.

A. Self-Regulating Electrolyte

1. The solubility of salts of the catalyzers $SrSO_4$ and K_2SiF_6 depend on temperature and the concentration of CrO_3. This dependence is presented. The optimium composition of the electrolyte is CrO_3-250–300 g/l, $SrSO_4$-5.5–6.5 g/l, K_2SiF_6-18-20 g/l.

2. For the general scheme of electrolysis the yield of chromium per current in self-regulating electrolyte attains 17.5–18.5 per cent, which has the possibility of increasing the chromium plating productivity by 40–50 per cent. The magnitude of the yield of chromium per current is little dependent on change of current density and temperature. The working temperature of the electrolyte should be above 50–55C.

Cathode current efficiency of chromium deposition is maximum at the concentrations of CrO_3 of 250–300 g/l. We studied the unusual influence of concentration of SO_4^{2-} and SiF_6^{2-} on the yield on the current efficiency.

3. We investigated the chemical stability of self-regulating electrolytes of lead alloys containing various quantities of Sn and Sb, and also the breakdown of these alloys on using them for an anode. The recommended optimum composition of the anode: 95–90 per cent Pb, 5–10 per cent Sn and the usual conditions in using the anode.

4. We obtained from a new electrolyte a deposit more smooth than deposits from the usual electrolyte. We studied structure, microhardness of deposit, and also internal stress, developed at the coating.

5. Experiments on using the baths in production showed it to be a high quality self-regulating electrolyte.

B. Tetrachromate Electrolyte

1. Tetrachromate electrolyte is interesting from the point of view of intensification of chromeplating and improving the conditions of work for the chrome plater. It is possible to obtain protective-decorative coatings without copper and nickel undercoatings.

2. We studied the influence of composition of electrolyte and the procedure on the yield per current. The optimum composition of the electrolyte is as follows:

CrO_3	350–400 g/l
SO_4	2–2.5 g/l
NaOH	40–60 g/l
Sugar	0.8–1 g/l

The temperature of the electrolyte is 18–22C, current density 40–80 a/dm². The deposit of chromium gave a cathode current efficiency of 25–30 per cent.

3. We obtained a deposit having a gray color, but it polished well to a mirrorlike lustre. We studied the influence of parameters of the electrolysis on microhardness and porosity of the deposit and also on the internal stress developed by the coating.

CHROME PLATING WITH A SELF-REGULATING ELECTROLYTE

by V. M. Semin

At the present time electrolytes used for chrome plating contain sulfate as the material for a constant ion, which is insufficiently stable for the process of electrolysis and is characterized by a low yield of chromium per current.

We established that the electrolyte, the components of which go into the chromic acid and also salts of limited solubility—potassium fluosilicate and stronthium sulfate, in quantities exceeding their solubility, would automatically maintain a constant concentration of these foreign anions—fluosilicate and sulfate—and thus it becomes self-regulating.

The mechanism of self-regulation is that the salts found in the electrolyte in the form of deposits on the bottom of the bath, go into solution and replenish it with the constant anion maintaining its concentration in the electrolyte as it is removed in the chrome plating process.

As compared to "sulfate" a self-regulating electrolyte has several advantages: yield of chromium per current is higher on the average by 40 per cent and under the same conditions of chrome plating, it remains constant; in changing the temperature of solution the yield of chromium per current has significantly less change; the area of shiny deposit obtained has a wider diaposon temperature, admixtures of metals Fe^{3+}, Cr^{3+} and Zn^{2+} has significantly less influence.

The composition of the self-regulating electrolyte is: 250–300 g/l CrO_3; 6 g/l $SiSO_3$; 20 g/l K_2SiF_6.

The scheme of chrome plating (in the range of deposition of bright chromium): the temperature is 50–70C, current density 40–100 a/dm²; yield of chromium per current 17–21 per cent.

In production conditions the self-regulating electrolyte is the most profitable to use for depositing thick layers of chromium and for cases of large scale chromium plating.

DECORATIVE AND POROUS CHROME PLATING FROM SELF-REGULATING ELECTROLYTES

by S. N. Chesnokova

1. We conducted investigations with self-regulating electrolytes for the purpose of studying the basic parameters of electrolytes and the possible use of the electrolyte for porous chrome plating of piston rings for tractor motors. It was established that self-regulating electrolytes were stable under given conditions of electrolysis, the yield per current attained 19–20 per cent and it also was possible to work in the interval of current density from 30 to 170 a/dm² at temperatures of 50–70C. In the process of investigation we developed methods of analysis for quantitative determinations of SO_4 and SiF_6 in the electrolyte.

2. The data obtained permitted the successful use of self-regulating electrolytes for porous chrome plating of piston rings.

The work was conducted according to the following scheme:

Chrome Plating

Current density	100 a/dm²
Temperature of electrolyte	60C

Dichrome Plating

Current density	45–50 a/dm²
Temperature of electrolyte	50C

As the result of the use of a self-regulating electrolyte, the process of chrome plating was accelerated more than two times; the requirements in technical conditions for thick layers of chromium on piston rings lies in the range 0.14–0.20 mm being attained in two hours instead of five.

We developed a process of chrome plating to ensure obtaining a coating on the piston rings which satisfies all the requirements of TU as to the quality of chromium and the depth of the pores, structure and adhesion.

3. With imperfect self-regulating electrolyte, it is necessary to reduce its high chemical activity. For isolated glass baths we used a greased diabase. For preventing solutions of the internal non-chromed part of the piston ring we used a specially constructed support.

4. NII Agric. Mach. jointly with MZMA introduced the self-regulating electrolyte for decorative chrome plating of automobile parts.

Parts are chromed by double layer coatings of Cu-Ni at an electrolyte temperature of 50C and a current density of 60 a/dm².

In use, it was made apparent that standard self-regulating electrolyte was more preferred for the following reasons:

a) High yield per current attaining about 19 per cent which gives economy of electrical energy by more than 20 per cent.

b) A constant relationship between the concentration of CrO_3 and $SO_4^{=}$ in solution which ensures the stability of yield per current.

c) The content of anion in the electrolyte is supported automatically, which significantly abbreviates and simplifies control of the bath.

ELECTROCHEMICAL CHROME PLATING FROM SOLUTIONS OF TRIVALENT SALTS OF CHROMIUM

by I. A. Bodrov and N. T. Kydryavtsyev

1. The process of electrolytic chrome plating from solutions of CrO_3, widely used in industry, is essentially unsatisfactory; harmful vapors of electrolyte, low electrochemical equivalence of chromium, bad yield of metal per current, etc.

Electrolytes based on trivalent compounds of chromium are less harmful, the electrochemical equivalents of the chromium evolved from these are two times greater than from solution of the hexavalent compounds of chromium, but they have as yet been little studied and are not used in industry.

2. We investigated solutions of $Cr_2(SO_4)_3$ and $(NH_4)_2SO_4$, both with additives and without them. We studied the influence of concentration of the basic components of the solution, pH, temperature, and current density and also the material of the anode, and the quality of the deposit and the yield per current.

Good results were obtained from electrolytes of the following composition: $Cr_2(SO_4)_3$-0.5 mol/l, $(NH_4)_2SO_4$-2.5 mol/l, $FeSO_4 \cdot 7H_2O$-1 g/l at pH 2.3-2.7; temperature of the electrolyte is about 40C; current density at the cathode 8–10 a/dm². Yield of metal per current 22–23 per cent. The anode was of magnetite. The bath was without diaphragms.

3. We conducted experiments with the electrolyte on the stability according to composition in dependence on the material of the anode and the electrolysis process.

It was shown that at the anode of fused magnetite Cr^{3+} is practically not oxidized to Cr^{6+} over a wide interval of current density.

Using an anode of magnetite permits regulation and maintenance of a constant concentration of salts of iron in the electrolyte due to the partial solubility of it during the time of electrolysis.

Cooling the solution to 20C for a short time (one day) to full transition of the green modification of the chromium salt to the low solubility violet one, does not show an influence on the quality of deposit of chromium or yield of metal per current.

CHEMICAL NICKEL PLATING

by A. A. Nikiforova and K. M. Gorbunova

1. The rate of application of coatings by means of reduction of nickel salts using hypophosphite depends on a series of factors. The most effective of these is temperature, acidity of solution, and also the nature of the limiting compound, introduced into the solution as a buffer, but showing a specific influence on the process.

In conformity with the American patent data, the rate of the process is shown to be largely influenced by the concentration of hypophosphite under the conditions to maintain an optimal relationship between the quantity of nickel salts and hypophosphite.

2. In our investigations conducted with the purpose of acceleration of the process it was discovered that increased concentrations of hypophosphite increased the rate of reduction of nickel only in the case where the solution maintains a specific relationship between the concentration of hypophosphite and the "buffer" compound. This dependence is established for solutions with added sodium acetate at different concentrations of hypophosphite and confirmed with other "buffer" compounds.

3. The relationship between concentrations of hypophosphite and the limiting additive is shown essential not only in relation to the rate of the process but also in relation to the quality of the coating. At concentrations of buffer compound, exceeding the optimal magnitude, coatings become dull, banded or even dark.

4. The efficiency of the process of chemical nickel plating drops to the degree where change occurs in the composition of the solution in the course of the reaction. Without correction of the solution the process may even stop completely. The use of a correcting solution with phosphite in it is difficult.

For eliminating the poisonous influence of phosphite accumulating in the bath as a result of oxidation by hypophosphite, it is necessary to introduce a complex former.

On checking the action of a series of similar substances, good results were obtained by adding glycine. In the presence of the latter, it is possible to correct the solution, which permits the maintaining of a constant rate of reduction.

5. We investigated the dependence of the rate of the process on the content of nickel salt in solution for different compositions and showed that the influence of these compounds is different depending on the concentration of hypophosphite. Where solutions with low concentrations of hypophosphite are used, a change in the content of the nickel salt has little effect on the rate of the process over a wide range of change. But in solutions with increased content of hypophosphite, the concentration of nickel salt has a significant influence on the process. With even higher concentrations of reducer, the greater the degree to which the interval of variation of concentration of nickel salt narrows.

6. As a result of experiments conducted for the purpose of regenerating the used solution in which a large quantity of phosphite has accumulated, it was shown possible to remove from solution this product of reaction using iron chloride. The latter forms with phosphite a nearly unsoluble complex compound, easily removed from baths by filtration. Experimental solutions (containing glycine) after removing phosphite may be used again for nickel plating.

USE OF CHEMICAL NICKEL PLATING FOR CORROSION PROTECTION AND INCREASED DURABILITY OF PARTS

by S. A. Vishenkov

a) Acid baths for chemical nickel plating (*p*H 4–6) are simple as regards composition, but are essentially unsatisfactory due to low stability; i.e., the rate of deposition of nickel after 3–4 hours of working the bath abruptly decreases. Better stability and greater rate of deposition is obtained from baths in which the molar relationship of nickel and hypophosphite is 0.4. From what is known at the present time, acid baths show better results when composed of the following:

Bath No. 1: Nickel chloride 21–22 g/l, sodium hypophosphite 23–24 g/l. Sodium acetate 10 g/l; *p*H of 4.9–5.1 (attained by acidification of a fresh solution). The temperature to conduct the process is 90–93C. The rate of deposition of nickel with these baths in the first hour of use is 25–28 μ/hr, the average thickness of coating after 8 hr is 10–12 μ/hr.

Presently known procedures of adjusting the acid baths used to support the stability of the solution are either extremely expensive or ineffective. Therefore, acid baths are expedient to use for a one-time full use of the solution and then replacement. In acid baths, it is recommended that parts be coated which are of dark metals. Initial preparation of parts before nickel plating is the same as that before applying a galvanic coating.

b) Alkaline baths for chemical nickel plating (*p*H of 8–9) are more stable in use, are corrected without particular difficulty, ensuring a uniform rate of deposition of nickel of 17–19 μ/hr over the course of 100 hr. In alkaline baths it is convenient to nickel plate parts of black and light metals, and even a number of aluminum alloys. Positive results are given by baths consisting of 21–22 g/l of nickel chloride, 23–24 g/l of sodium hypophosphite, 30–32 g/l of ammonium chloride, 45–47 g/l of sodium citrate, 50–55 ml/l of an aqueous solution of ammonia (25 per cent); *p*H of 8–9; temperature of the process is 85–92C. Correction is done by adding nickel salt, hypophosphite and aqueous ammonia in quantities equal to those used up on coating the parts. The significance of these magnitudes may be obtained by a calculation from subsequent more precisely made experiments. In alkaline baths it is convenient to nickel plate chiefly parts of aluminum alloys. The parts are previously prepared from aluminum alloys for chemical nickel plating, including degreasing and etching with a 5 per cent solution of caustic soda (0.5–1 min) at a temperature of 60–70C, clarified with a 50 per cent solution of nitric acid, and a zincate treatment for 30–40 sec in a solution consisting of 500 g/l sodium caustic and 100 g/l of zinc oxide. The temperature of the zincate solution is 20–25C. After each operation, the part is rinsed. For nickel plating a part of an aluminum alloy, containing 5–6 per cent or more of silica, brightening the part after etching is done in a solution of 650 ml/l of nitric acid and 350 ml/l of hydrofluoric acid. Completion of brightening is determined by the full removal of the etching slime from the surface of the part.

Before loading the aluminum part into the bath for chemical nickel plating aluminum sulfate is added after calculation, to 0.3 g/l. In connection with this, as the alkaline bath has in it complex acids, in many cases it is a good practice to apply a first layer of nickel in an alkaline bath and thereafter add a supplementary coating on the part to the required thickness in an acid bath.

We obtain in the described baths coatings containing from 3 to 10 per cent phosphorus, therefore these coatings are often called nickel-phosphorus. In coatings obtained from alkaline baths, the per cent of phosphorus is lower than coatings obtained from acid baths.

2. Thermal Treatment of Nickel-Phosphorus Coating

The valuable properties of nickel-phosphorus coatings may be fully utilized only after thermal treatment. For nickel-plated steel parts, the temperature of thermal treatment of the nickel-phosphorus layer is 380–400C.

For parts made of aluminum alloys the temperature of thermal treatment is 230–240C. The thermal treatment is continued for 45–60 min.

Thermal treatment sharply increases the durability of adhesion of the nickel-phosphorus layer to the base metal. So, in cracking experiments on nickel-plated samples, the non-thermal treated layers crumbled on a large part of the surface of the sample. Thermal treated layers after cracking of the sample were fully maintained, even on pivot samples. High stability adhesion of thermally treated layers were submitted also to experiments on bending and twisting, and on abrasion of chromed nickel plated samples.

Thermal treatment significantly increased the hardness of the nickel-phosphorus layer. Microhardness of untreated layers was 300–350 kg/mm², after heating at a temperature of 250–400 kg/mm², and at temperatures of 400C were 750–800 kg/mm².

3. Protective Properties of Nickel-Phosphorus Layers

The protective properties of nickel-phosphorus layers, obtained in acid bath No. 1 were compared to the properties of nickel layers of similar thickness obtained by electrolytic procedures. The electrode potential of chemical nickel coatings had a more electropositive magnitude than the electrolytic coating.

The porosity of the coating obtained by the chemical method has significantly lower magnitude than the electrolytic coating of the same thickness. The porosity of the nickel-phosphorus coating was significantly lower for coatings of given thickness applied for two-three applications and thereupon submitted to thermal treatment at temperatures of 380–400C for the course of an hour. In this case, nickel-phosphorus layers of a thickness of 22–25 μ remained practically non-porous. Nickel coatings of the same thickness but obtained by electrolytic baths had 35–40 times as much for the same surface area.

With experiments of sprays of 3 per cent solution of sodium chloride on samples of nickel-phosphorus layers of a thickness of 25 μ, the first corrosion point was found after 281 hr; samples with electrolytic nickel coatings of the same thickness—after 96 hours.

For rough conditions (ShC) we recommend a thickness of thermally treated nickel-phosphorus layers of 20 μ, non-thermally treated—25 μ; common conditions (CC) a corresponding 15 and 20 μ, for light conditions (LC)—10 and 15 μ.

Under conditions of gaseous corrosion (sulfur dioxide) at 300–350C nickel-phosphorus layers of thickness 25–30 μ did not change color; at 400–500C on such coatings, a tarnish appeared; at 500-600C, a dark stain developed. Nickel-phosphorus layers of a thickness of 10–15 μ on aluminum alloys, obtained from alkaline baths, gave reliable anti-corrosion protection under rough conditions of use.

4. Anti-Friction Properties[1]

Non-thermally treated nickel-phosphorus coatings were not able to serve as durable materials under a specific load of 5–10 kg/cm² and low rates of slip; there formed on the nickel plated surface deep lines that came through to the surface of the base metal (steel). As the result of thermal treatment for an hour in the temperature interval 650–900C, coatings acquired good anti-friction properties. For friction without oil on back and forth motion V_{max} =0.3 Mc/sec and a specific load of 10 kg/cm², the total loss of weight of the sample of nickel plate on steel (St. 45) after 100 hr experimentally was established to be 356 mg. Under the same conditions the total wear of a smooth chrome plated steel sample (St. 45) was 455 mg. In the same way the wear of a smooth chrome-plated sample was 77 mg and a nickel-plated one, 159 mg;—i.e., twice the amount.

On experiments with oil MC-20 on reversing motion at the rate of slip of 4.5 m/sec and a specific pressure of 50 kg/cm², the total wear of a pair of nickel plated surfaces of steel samples (St. 45) on 8 hours of experiment was 326 mg, and a pair of chrome steel ones, 252 mg. In this way, the wear of a chrome plated sample was 175 mg and a nickel plated one, 316 mg. Nickel-phosphorus coatings withstood almost twice the size specific load as smooth chrome coatings (corresponding to 100 and 55 kg/cm²).

The magnitude of coefficient of friction of nickel and chrome coatings under conditions of limited oil showed them to be equal at a range of specific load of 55 kg/cm².

On checking with a gripping set-up, the force of friction on nickel, as on chrome coatings, did not produce skipping. The surface of these samples did not have lines, or pulled out metal, but the evidence was that nickel-phosphorus coatings gave a capacity against pulling approximately equal to chromium coatings.

The maximum specific load that could be endured until pulling out of the nickel-phosphorus coatings occurred on samples thermally-treated in the temperature interval 350–900C, exceeded 420 kg/cm² under conditions of back and forth motion at the rate of 0.3 Mc/sec. with liquid oil AMG-10 at room temperature.

Under conditions of back and forth motion at the rate of V_{max} =0.3. Mc/sec with a specific load of P = 10 kg/cm² and lubrication oil MC-20, wear of a duraluminum pair (D1-1), nickel plated in alkaline baths and thermally treated at 240C, that of duraluminum was 6.5 times less than the wear of the pair duraluminum to duraluminum, but with the liquid oil AMG-10 it was 22.3 times less.

5. The Influence of Nickel-Phosphorus Coatings on the Mechanical Properties of Metals[2]

Both non-thermally treated and thermally-treated coatings of nickel-phosphorus at 400C temperature and a thickness of 30μ have no influence on the mechanical properties of steel 30ChGSA under a tension (σ_b; $\sigma_{0.2}$; δ_s; ψ) and do not show a noticeable influence on impact malleability of the steel 30ChGSA (with the initial magnitude Qk = 3.9 kg-m/cm²).

Thermal treatment at 400C of nickel-phosphorus coatings of thickness to 30μ depresses the range of fatigue endurance of steel 30ChGSA by 38–39 per cent, steel 40ChNMA and steel 30ChGSNA by 41–44 per cent. Thermal treatment at 240C of nickel-phosphorus coatings on castings of aluminum alloys Al-4A had no influence on the range of its fatigue endurance.

6. Mechanical Treatment of Nickel-Phosphorus Coatings[3]

Thermal treatment of nickel-phosphorus coatings on aluminum alloys Al-3A, D1-T and others may be treated by polishing upon cooling, abrading with castiron abraders and polishing—the scheme of polishing: a ring of E468M2 and EB80SM1K is rotated 280 times per minute and the ring is reversed 15,000 per minute; moving across 0.01 mm, with a longitudinal movement 3–6 Mc/min. The grinding process: grinding material—micropore M7 and M10 mixed with mineral oil. The chuck of the grinder can be clamped into the chuck of the lathe and the machine run at 380–500 OV/min. The part may be held back by hand. The thickness of nickel-phosphorus layer removed was found to be 0.01 to 0.05 mm. Polishing was done with a felt ring and thin paste GON. Grinding for the latter polishing ensures the cleanliness of the treated surface in the range 10th class according to GOST 2789–51.

[1] The investigation of anti-corrosion properties was conducted jointly with D. N. Garkunovim.

[2] The investigation of the influence of nickel-phosphorus coating on the mechanical properties of metals was conducted jointly with V. S. Borisovim.

[3] The methods of mechanical treatment were developed jointly with M. F. Ophitsyerovim.

(To be continued)

Metal Finishers, Inc., uses Mutual Chromic Acid in its "Mecrome" plating of cylinder liners. Each liner is examined with a microscope (above). Micro-photograph shows uniformity of pockets which retain lubricating oil.

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Many letters of greeting have been received by American Electroplaters' Society (AES) congratulating its members upon the Fiftieth Anniversary of their Society. As the AES enters 1959, its Golden Jubilee year, excerpts of some of these are published with the appreciation of AES to each and every well-wisher for his gracious expression.

"It gives me real pleasure as president of the Metal Finishing Suppliers' Association to convey to the American Electroplaters' Society on the occasion of its Golden Jubilee Year Anniversary, the warm and sincere congratulations of our membership and to extend our good wishes for the future.

"For thirty five of the past fifty years our two organizations have walked and worked together, holding our annual meetings in the same places and participating in each others' activities.

"AES conventions have always afforded the opportunity for the representatives of our member firms to enhance their education in the advancement of their chosen fields and to bring to these conferences the results of the latest research developments of their own companies.

"We of the MFSA have always been closely interwoven in structure with the AES through Boards, Committees, Delegates and Members and we have depended upon each other in many instances for the success of our mutual undertakings. It is, therefore, with increased pride that we will take part in the observances throughout the year and especially in the Detroit Convention next June and in the concurrent Industrial Finishing Exposition."

EARLE W. COUCH
President
Metal Finishing Suppliers' Association, Inc.

"On behalf of the American Chemical Society, I am glad to congratulate the American Electroplaters' Society on 50 successful years of progress . . . we join you in looking forward to many more successful years of cooperation between our two organizations."

C. F. RASSWEILER
President
American Chemical Society

"It is most pleasant to share in the good wishes of our fellow technical societies and it is our desire to cooperate in any way possible toward strengthening this mutual friendship.

"The combined efforts of our societies can accomplish a great deal for the future of our economy and the American way of life."

G. A. GOODWIN
President
American Society of Tool Engineers

"On behalf of the Society of Plastics Engineers, Inc., I take this opportunity to congratulate American Electroplaters' Society on its Fiftieth Anniversary.

"We share your hope that the spirit of cooperation between our Societies may grow stronger with each succeeding year."

R. K. GOSSETT
National President
Society of Plastics Engineers, Inc.

"I want to express my very best wishes to the American Electroplaters' Society, Inc., upon the occasion of your Fiftieth Anniversary."

H. THOMAS HALLOWELL, JR.
President
American Standards Association, Inc.

"Our best wishes to you and to the AES for a successful anniversary year. It is our hope that the pleasant and rewarding relationship between the NAMF and AES will continue for years to come."

GEORGE W. TAYLOR
President
National Association of Metal Finishers

"We rejoice with you at this time and reciprocate with best wishes for your continued success. The American Electroplaters' Society has played a most important role in the industrial development of the past. It will unquestionably make many valued contributions in the future."

G. M. YOUNG
President
American Society for Metals

"Congratulations to you on your 50th Anniversary. I join with you in the hope that the many mutually fruitful years of good relationship enjoyed by ASTM and your Society continue for many years to follow."

K. B. WOODS
President
American Society for Testing Materials

"The NACE sends congratulations to the American Electroplaters' Society, Inc., on having completed fifty years outstanding service to American industry. We . . . assure you the NACE will always be pleased to cooperate wherever we can with your fine Society."

T. J. HULL
Executive Secretary
National Association of Corrosion Engineers

"I appreciate your reminder of the 50th birthday of AES, because it gives me this opportunity to wish you, and all of its members, many happy returns."

WILLIAM K. CRESON
President
Society of Automotive Engineers, Inc.

"We wish the American Electroplaters' Society, Inc., all success in years to come and particularly during this, its Fiftieth Anniversary, year."

W. C. GARDINER
Acting President
The Electrochemical Society, Inc.

Our heartiest congratulations to your Society upon its 50th Anniversary. We as an Institute have always had the friendliest relations with your Society, and many of our members are personal friends of your members. May this co-operation continue in the same spirit in future years.

We are many of us looking forward to the International meeting in Detroit in the summer of 1959, and I take this opportunity of sending you and your colleagues all our best wishes for its organization and success.

T. P. HOAR
President
Institute of Metal Finishing
London, England

MILESTONES OF AES

A PLATING MAGAZINE original feature during this observance fiscal year of the **FIFTIETH ANNIVERSARY** of its parent, American Electroplaters' Society, Inc.

JAPANESE aggression had expanded perilously on one side of the globe by 1940. On the other, Fuerher Adolph Hitler's mighty Nazi military juggernaut had already invaded and subjugated many nations of Europe. Across the English Channel, Britons were making the stand for survival characterized by the spirited words of Prime Minister Winston Churchill, ". . . We shall defend our island whatever the cost may be; we shall fight on beaches, landing grounds, in fields, in streets and on the hills. We shall never surrender. . . ."

On this continent, our nation, overcoming isolationism, had embarked upon a great National Defense Program. We had military, naval and air strength in the making. We were truly becoming the Arsenal of Democracy. In 1940, American war production was insignificant—by 1942, it had already swelled to a volume fully equalling that of Germany, Japan and Italy combined. We had dedicated ourselves to National Defense.

National Associations and Societies had received great impetus for performance and progress under the NRA. Under the National Defense Program, later the Victory Program, they received their greatest opportunity to serve. Order of that day was to further our country's Defense effort by effective accomplishment of job. The mission of the AES was research and nourishing technical and scientific knowledge in electroplating, metal finishing and allied arts. Still composed principally of foremen platers, chemists and engineers, AES not only concentrated upon its own sizable assignment but also volunteered to the Defense leadership for any additional "Defense" service within its power.

And so as to expand to a targeted 2600 members by 1941, it inaugurated its annual Branch membership promotional competition in 1940 that has continued to recognize Branch accomplishment in this connection through the years to this day. To the winning Branch, annually, in that era went the handsome "AES Membership Trophy." Meanwhile, as a further spur to educational enrichment, AES had launched its first regional meeting in 1939. Composed of five New England Branches, namely Bridgeport, Hartford, New Haven, Springfield and Waterbury, that group initiated the yearly New England Regional assembly that today is the patriarch among five such organized regions and cooperative regional events, namely Dixie, Empire State, Midwest, New England and Tri-State (Indiana, Kentucky and Ohio).

By year-end 1940, the AES had assimilated its 29th Branch, Indianapolis—a new Branch succeeding the Branch in that Hoosier capital city that had become a depression casualty in 1933. In the wake of that happy Branch reentry, however, came shooting war. On December 7, 1941, the Japs ravaged Pearl Harbor. Promptly America became a combatant. "No matter how long it may take to overcome this premeditated invasion," President Roosevelt proclaimed, "the American people, in their righteous might, will win through to absolute victory."

WORLD WAR II saw America reach history's zenith in productive performance. Zinc, nickel, cadmium, copper, cyanides, tartarates, chromium and other critical needs of the Victory Program went to war—non-war needs of these commodities were rightly left to fend for themselves as best they could. During this era of short supply, substitution, simplification, conservation, standardization came to the fore. In its Annual Meeting program on December 6, 1942, the Detroit Branch appraised AES status thus:

> The function of the AES is going to be to keep interest in plating alive throughout the period of curtailment; to see that interest in plating does not cease; to see that plating is specified where it is of advantage to war; and that if it is possible to do some decorative plating without impairing the war effort, that this be permitted. It will be its function to see that an adequate body of men are kept acquainted with plating so that when the war is over, they will be able to make the world a better place in which to live. The Society has a great duty to perform during a discouraging period, but it will not fail.

Eventually, the Allied Nations assumed the initiative, and, in due course, came D Day—the overrunning of France—the piercing of the Siegfried Line—the surrender of the Reich—the atom-bombing of Hiroshima—conquest of Japan—finally the end of history's most costly and destructive war in autumn 1945 on the very basis prophesied but never witnessed by the late President Roosevelt who had deceased on the very verge of Allied total victory.

And during that grim but victorious period, electroplating had fared thus:

> Electroplating learned in the high pressure stress of war, that electroplating is far more than just a "luxury finish" to add style, beauty and glamor. We've learned, for example, that plating multiplies the life and efficiency of cutting tools. We've learned that plating can make a steel shell do the work of a brass shell. We've learned that plating can make a tin can better and cheaper. Over and over, we've searched out and put into war use, applications for plating that justified themselves on strictly utilitarian ground. We now know how to make plating mean money-saving, cost-reducing efficiency while promoting usefulness as well.

THE AES started the war period pursuing a membership expansion goal of 2600 members—and it ended that World War II era with over 4000 members in autumn 1945. In that span, it added a Branch in Lancaster (Pa.) in 1943, and another in Jackson-Lansing (Michigan) in 1944 that is today's Central Michigan Branch. It took a

SECOND OLDEST BRANCH HEARS AES PRESIDENT

President A. W. Logozzo delivers 2nd Annual George Gehling Memorial Lecture before Philadelphia Branch, Autumn 1949.

major step forward by chartering a Branch in Australia in January 1944 with 40 Charter Members and with Sydney as that group's locale of record. The Rockford (Ill.) and Twin City (Minn.) Branches were born in 1945. That year-end, therefore, AES boasted 34 Branches, distributed 31 in the United States, 2 in Canada and 1 in Australia.

But Death had dealt AES a hard blow when it took William J. R. Kennedy, its able, long-time Executive Secretary and MONTHLY REVIEW publisher on August 7, 1942. Past President Ellsworth T. Candee served as such to August 1945. He was, in turn, succeeded by Dr. A. Kenneth Graham. National Headquarters was located at 545 Fifth Avenue, New York City, under Executive Secretary Candee—moved to Jenkintown, Pennsylvania, under Executive Secretary Graham—came to 445 Broad Street, Newark, N. J., its current site, under Executive Secretary D. Gardner Foulke in April 1952.

Then Death struck again on December 3, 1942. On that day, Founder Charles Henry Proctor died at his home in Avon, N. J. at the age of 76 years. Grief-stricken AES mourned his loss. "The AES," wrote First AES President Hogaboom, "shall always be a memorial to Charles H. Proctor."

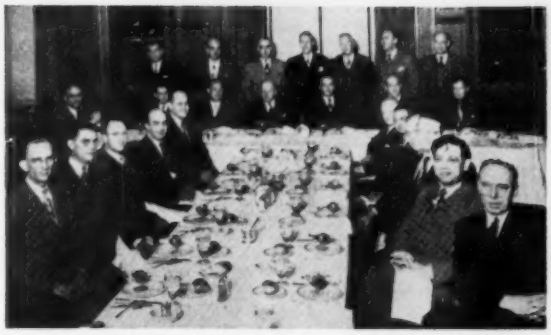
WAR'S END found our nation confronted by the challenging trek back along reconversion pathway. Industry returned to peacetime enterprise to supply the pent-up demands of America's nearly 145 million population. Millions who composed this nation's military, naval and air might reentered civilian status, each naturally seeking employment, reemployment or further learning. Employment and education consequently boomed. There were countrywide complexities, including stresses and strains in management-labor relations, but America was surely enroute to unprecedented prosperity. For the AES, the period ahead was also blessed with progress.

Under C. E. Heussner in 1945-1946, AES Research Projects were initiated, for the first time, in American and Canadian universities and foundations, beside the National Bureau of Standards (NBS), instead of exclusively in the NBS as previously.

To finance cost more efficiently, the AES, at its Annual Meeting in Pittsburgh in 1945, created a Sustaining Membership classification, and authorized the election to such AES membership of any acceptable company contributing $100 or more to the support of the Research Program per annum.

In 1946, the first silverplated "pot" of the "Order of the Pot" (now "Order of Past Presidents") was presented at that year's Baltimore-Washington Branch Annual Meeting to then-President Walter L. Pinner by the award's creator, namely Past President Kenneth M. Huston. Thus, at the Maryland Yacht Club in Baltimore that spring, was inaugurated the tradition whereby each outgoing AES President, in the twilight of his administration, is presented with such a "pot" at the traditional ceremony featuring the Annual Meeting of the Baltimore-Washington Branch.

As another forward step in 1946, the Society set members' dues to be paid to the Supreme Society (per capita tax) at $4.70 per member. And in 1947, a five-man Constitutional and Bylaw Revision Committee was established to modernize and streamline those instruments in keeping with changed times and the Society's expanding status and needs.



BOARD IN ACTION IN LATE 40'S

Executive Board confers with leadership of the Detroit Branch, Spring 1949. Seated back row (l to r) Past President K. M. Huston (third from left), National President S. S. Johnston, 3rd Vice President C. F. Nixon, 1st Vice President A. W. Logozzo, 2nd Vice President W. J. Neill.

Headed by Arthur W. Logozzo (Hartford) and including Franklyn J. MacStoker (New York), F. R. Keller (Pittsburgh), Cleveland F. Nixon (Detroit) and Clyde Kelly (Chicago), the Committee's product, namely today's AES Constitution and Bylaws, was considered and adopted by the Supreme Society at its meeting in Atlantic City, N. J. that June 1948. With a broadened base, AES, structurally, was now ready for its swelling future.

AS AES entered 1949, trouble was brewing in the Orient. The nation's prosperity was slackening a bit, but the United States had taken giant social and economic strides forward since World War II. Our population stood at approximately 150 million—our national income topped $216 billion compared with about $81 billion the decade before—retail sales had soared to $150 billion compared with $42 billion in 1939—there were 81 million radios and approximately 2.5 million television sets in use in '49 as against about 29 million radios in homes in '39.

Since 1946, the AES had chartered nine Branches. This included Branches "Down Under" in Adelaide and Melbourne in 1946, and St. Joseph Valley (Indiana) and Columbus (Ohio) assimilated by AES here in that same year. In 1947, the AES had penetrated America's Southland with its Southeastern Branch embodying Alabama, Georgia, Florida, the Carolinas and Mississippi. And in 1948, AES added its Louisville (Kentucky), the Saginaw Valley (Michigan), and Western Ontario (Canada) Branches, plus the Winston-Salem (N. C.) Branch that died in '49. On January 1, 1948, moreover, AES's MONTHLY REVIEW became today's PLATING MAGAZINE. And in its Fortieth Anniversary Year in 1949, the Society chartered its Allentown-Reading (Pennsylvania) and Hamilton (Canada) Branches.

Consequently, forty years after its humble beginning by Founder Proctor in New York on April 10, 1909, the AES had grown to 5220 members and to 44 well-established Branches spanning (East to West) from Knickerbocker to the Golden Gate in the United States, and (North to South) from the Dominion of Canada to the Commonwealth of Australia. AES had a significant "today" in '49—but even greater challenge, service and progress lay in store for its "tomorrow."

—JOHN P. NICHOLS

GOLDEN JUBILEE OBSERVANCE IN NEWARK, DECEMBER 13, 1958

Preceded by an Educational Session held Friday evening, December 12, Newark Branch held its 45th Annual Banquet at the Robert Treat Hotel with a large attendance and with GOLDEN JUBILEE background. 1) The cocktail party before the crowd thickened. 2) A view of the banquet hall's decor. 3) One section of the well-attended banquet. 4) PLATING MAGAZINE pays its respects, 5)Part of the dancing platers and their guests. A corner of the GOLDEN JUBILEE flag shows in background. 6) Branch President Gus Bittrich's table. Clockwise bottom left to right: Branch Librarian Al Korbelak; Mrs. Bittrich; Mr. Bittrich; Mrs. Wesley; National Second Vice President W. Andrew Wesley; Mrs. Nichols; John P. Nichols; AES Past President George J. Wagner; Henry Fiorini, representing Mayor of Newark prevented from attending due to illness; Chief Magistrate Nicholas Castellano of Newark, Mrs. Korbelak. 7) Banquet Honorary Chairman Wagner's table includes Mrs. Wagner and AES Past President and Mrs. George P. Swift (foreground); Mr. and Mrs. F. J. LaManna and Mr. Wagner (background).

PAPER AWARDS COMMITTEE PREPARING TO MAKE 1959 SELECTIONS

With eight AES Paper Awards in contention, including the Carl E. Heussner Award Gold Medal, a strong Paper Awards Committee is busily studying all PLATING MAGAZINE and 1958 Convention papers from among which eventual selection will be made. The Committee is headed by Frank O. Beuckman of the Rochester Branch and includes R. Scott Modjeska of the Chicago Branch and Otto Bert Kirchoff of the Buffalo Branch.

Laboring against a March 15 selection deadline, actual winners will be announced by Chairman Beuckman at the first Business Session of the Supreme Society to be held at the GOLDEN JUBILEE Convention in Detroit, June 15, 1959. By action of the Executive Board, the procedure for notifying winners was recently altered so that such winners may be notified in confidence in advance thereby enabling them to plan to be at the award ceremonies.

Aside from the Heussner Award, published PLATING and convention papers are vying for the AES Silver and Bronze Medals and the George B. Hogaboom Award; the Robert S. Leather Award; the Chromium Plating Award; the Precious Metal Plating Award and the new John J. Hanney Memorial Award instituted in 1957 but yet to be won.

The Hogaboom, Leather, Chromium, Precious Metal and Hanney Awards are respectively sponsored by the Hartford Branch, Lea Manufacturing Company, Nutmeg Chrome Corporation, Technic, Inc. and the Grand Rapids Branch jointly with the Metal and Thermit Corporation.

AES NEWS

LIVING FOUNDING FATHERS TO BE HONORED BY AES's MOTHER BRANCH

Honoring its living founding fathers, namely, Justus A. Stremel, Harry C. Bernard and William J. Schneider, the New York Branch, AES's "Mother Branch," will celebrate its FIFTIETH ANNIVERSARY during the Society's own GOLDEN JUBILEE with an impressive full-day's assembly on Saturday, February 7, starting with an educational session and ending with a heralded Anniversary banquet, program, floor show and dance in New York City's spacious Statler Hotel. An ambitious Ladies Program will supplement the festive day.

One of the farsighted foremen platers who collaborated with Founder Charles Henry Proctor in the conception of the National Electro-Platers Association of the United States and Canada, AES's progenitor, Mr. Stremel participated in the long weeks of planning that culminated in the birth of NEPA at New York's venerable Hotel Chelsea on Saturday, April 10, 1909 when G. B. McLellan was Mayor of the Empire City.

He and Messrs. Bernard and Schneider were stalwarts of the Association before its transformation into today's AES in New York on June 1, 1913. Accordingly, they have been active and devoted members of the Mother Branch for some five decades, and passing time has had little effect upon their continuing AES and New York Branch dedication and activity.

To honor these men who symbolize the mettle of the founding fathers of this Society, and to mark appropriately the half-century service of the Mother Branch in fostering the well-being of electroplating and metal finishing, a record turnout of members and their families and guests, including many representatives of other Branches, are expected to attend AES's special day in the sun in Knickerbocker. Among those present will be National President Herberth E. Head and at least three other of AES's six national officers. Under the golden banner of the Golden Jubilee, the Mother Branch will honor the foregoing three of its surviving creators.

The educational sessions will feature three authorities. Dr. Henry Brown, Director of Research of the Udylite Corporation will discuss, "Corrosion Studies with Various Combinations of Nickel and Chromium Plate." Walter L. Pinner, McGean Chemical Company and President of the International Council of Electrodeposition and Metal Finishing, will speak on "Copper-Nickel-Chromium Exposure Steel." Dr. D. Gardner Foulke, Hanson-Van Winkle-Munning Co., will present "Nickel Plating for the Last Fifty Years." Arthur Carlson, Branch Librarian, is the event's Educational Chairman. Joseph Rembecki is the Mother Branch's General Chairman of its half-century observance.

MOTHER BRANCH PRESIDENTS

FIRST: CHARLES H. PROCTOR (1909)

TODAY: DR. E. B. SAUBESTRE (1959)

INDUSTRY'S STORY TO BE EXHIBITED AT GOLDEN JUBILEE EXPOSITION

The history and current status of electroplating and metal finishing will substantially be depicted through exhibits at the AES's FIFTH INDUSTRIAL FINISHING EXPOSITION, a feature of its GOLDEN JUBILEE CONVENTION, created by PLATING MAGAZINE, "Metal Finishing Magazine" and "Products Finishing Magazine."

Essentially, the exhibit areas of the three foregoing bodies, each an entity of its own, will be lounges for rest and relaxation by the Exposition's heavy and busy traffic. Sited at a distance from one another, each, however, will portray a different but coordinated phase of the growth and progress of plating and metal finishing through displays, showcases, physical exhibits and other visual aids.

The PLATING MAGAZINE phase, for example, will be an element of the FIFTIETH ANNIVERSARY LOUNGE of the AES itself and its PLATING MAGAZINE and AES Research Program. Here relaxing crowds will visually see unfurled before them, the dramatic biography of the AES from scratch in 1909 to date—plus not only the visual story of the magazine but also of the vital Research Program being conducted by the AES through specific projects at various American and Canadian universities and foundations. From the trained staff manning the Lounge, audience will be able to receive desired fuller information orally and via pinpointed printed matter.

BRANCHES DESIRING EXHIBIT SPACE CONTACT EXPOSITION CHAIRMAN

The decision of the overwhelming number of AES's 58 chartered Branches not to create Branch exhibits for show and competition during an AES Industrial Finishing Exposition year (decision evidenced in AES's recent direct poll of its 58 Branches), caused the Executive Board to refrain both from establishing a formal Branch exhibit program during the GOLDEN JUBILEE CONVENTION, and from setting up exhibit awards.

So as to accommodate the few Branches expressing themselves as desiring to exhibit at the EXPOSITION, however, the Board has arranged for these Branches to receive free exhibit space. Any such Branch is required to make its own individual arrangements for such free space by communicating promptly and direct with Howard J. McAleer, Exposition Chairman (Formax Manufacturing Co., 3171 Bellevue, Detroit, Michigan).

Such exhibits must not be commercial, according to the Board, but must reflect status of the plating, finishing and organic coating art; supply practical information about methods and processes, or inform concerning the progress of plating, metal finishing and organic coating.

"AES MEMBERSHIP: ITS MEANING TO YOU" PUBLISHED

"AES Membership: Its Meaning To YOU" is the title of the effective booklet just published by National Headquarters to meet the demand for membership information being sought from it by individuals in electroplating and metal finishing here and abroad considering joining AES either as Branch Members or Members-at-Large. Much of this request for such information seems to stem from the story of AES being told through its GOLDEN JUBILEE observance program now reaching maximum momentum.

Membership Committee Chairman Manuel E. Ben, with Executive Board blessing, has communicated with each of AES's 58 chartered Branches setting the GOLDEN JUBILEE membership expansion goal at a minimum of 12 acceptable additional Branch members per each Branch over and beyond those elected or reinstated by respective Branches during the period from July 1, 1958 through December 31, 1958. In behalf of the Board and his Committee, he has urged maximum Branch effort to meet that objective.

As a help to Branches, copies of the new booklet have been issued to the Branch secretary of each Branch for Branch use as a visual aid in accomplishing mission.

GOLDEN JUBILEE ISSUE
PLATING MAGAZINE
JUNE 1959
WILL INCLUDE ITS
"KALEIDOSCOPE OF AES's
FIRST HALF CENTURY

AES HAS DEEP ROOTS IN PENNSYLVANIA

As a corporate entity, American Electroplaters' Society, Inc. (AES) has had roots in three States as a non-profit educational corporation in its half-century lifetime, namely New York, New Jersey and Pennsylvania.

AES was a New York corporation from birth to 1930. It became a New Jersey Corporation in 1930. It headquartered itself in Jenkintown, Pennsylvania, in 1946 and operated as a properly authorized New Jersey Corporation in the Commonwealth of Pennsylvania until 1952. Still a New Jersey Corporation, it moved its headquarters to Newark in 1952.

Hence, AES has a significant background in the Keystone State, particularly in Philadelphia wherein its historic Philadelphia Branch has longevity extending clear back to 1910. Second oldest chartered Branch of the Society, that Quaker City Branch will observe its own FIFTIETH ANNIVERSARY in 1960. Reportedly, it will bid for the Seventh Interim Meeting to serve as climax event of its half-century observance.

Philadelphia's official view of AES generally and the Philadelphia Branch specifically is exemplified by the official greeting to AES on its GOLDEN JUBILEE recently received from the City's famed Mayor, Richardson Dilworth. The Society extends its hearty thanks to Mayor Dilworth and its friends of the City of Brotherly Love.

Other AES chartered Branches in the Pennsylvania Commonwealth include Pittsburgh chartered in 1919 and observing its Fortieth Anniversary in 1959. Bicentennial, too, of Pittsburgh itself. Others and their birth years are Lancaster (1943) and Allentown-Reading (1949). It might be added with respect to Interim Meetings of the Supreme Society, that the first such meeting was held in 1951—in Pennsylvania—in Philadelphia.

DAYTON'S ANNUAL IMPORTANT GOLDEN JUBILEE EVENT

The Thirteenth Annual Educational Session and Dinner Dance of the Dayton Branch is to be held on March 7 at the Hotel Biltmore in Dayton, Ohio. The program that has been formulated in this Golden Jubilee year of the AES is reported to be entirely worthy of the Society's celebration of which it is a part.

Three papers will be presented that afternoon. Dr. Frederick A. Lowenheim of Metal & Thermit Corp. will present "Corrosion of Plated Finishes;" Ezra A. Blount, editor of Products Finishing will talk on "Factors Affecting Job Plating Costs" and William K. Murray, Enthone, Inc., has chosen as his topic "Stripping of Organic Coatings." John P. Nichols, national executive secretary, has accepted the honorary chairmanship of the Educational Session.

Richardson Dilworth

To the Members of the American Electroplaters' Society:

On behalf of the city and the citizens of Philadelphia, I wish to extend greetings and all good wishes to the American Electroplaters' Society on the occasion of its Golden Jubilee.

The past half-century has been a period of tremendous progress and accomplishment in the field of electroplating and metal finishing, and I am happy to say that Philadelphia has had a hand in the great contribution your industry has made to the national economy. Our city has long been a leading center of your industry. It is also the home of one of the largest and most energetic branches of your society.

Heartiest congratulations on your 50th Anniversary!

RICHARDSON DILWORTH
Mayor of Philadelphia

GOLDEN JUBILEE CONVENTION INFORMATION MAILED

A brochure containing full information concerning AES's GOLDEN JUBILEE CONVENTION, Industrial Finishing Exposition and International Conference on Electrodeposition and Metal Finishing to be held in Detroit, Michigan, June 15-19, 1959 as climax of AES's FIFTIETH ANNIVERSARY observance was mailed by National Headquarters, January 9, 1959 addressed to every Active, Student, Honorary and Sustaining Member and Member-at-Large of the Society whether domiciled here or abroad.

A Hotel Reservation form was included in each such brochure. Due to expected large demand for accommodations, earliest possible filing of that form is recommended and urged.

HOST: AES
DIXIE REGIONAL GROUP

INTERIM MEETING REPORTER

DINKLER-PLAZA HOTEL
ATLANTA, GEORGIA
FEBRUARY 14, 1959

(Photo by Andrew Catchmark, Chrysler Corp.)

Aside from the yeoman planning and effort provided by the Detroit Branch leadership and by the industrious, expert, functional committees of that Branch, veteran of four prior AES Annual Conventions and pioneer of AES Industrial Finishing Expositions, there is also need for national coordination in any such mammoth enterprise as AES's GOLDEN JUBILEE Convention and Finishing Exposition including the International Conference on Electrodeposition and Metal Finishing, that will concurrently be held in Detroit, June 15-19, 1959. Above left, one such Detroit coordination meeting. (LEFT) Left to right: General Convention Chairman Wright W. Wilson; International Conference Chairman Walter L. Pinner; National Executive Secretary John P. Nichols: First Vice President Ralph D. Wysong; National President Herberth E. Head and Housing Chairman William P. Katke. (RIGHT) A dinner meeting of the Detroit Branch Executive Group with National Officers as guests. Clockwise from left: Francis T. Eddy, Chester G. Borlet, James D. Thomas, Leland M. Morse, Frederick Olmstead, Ralph D. Wysong, Edward J. Kubis, John Hitchcock, Branch President Manuel E. Ben, Robert C. Trees, Wright W. Wilson, John P. Nichols, National President Herberth E. Head, Vincent Cassidy and Glenn Friedt.

Mayor Stanley J. Davis signing the Proclamation establishing January 12-17 as "AES Golden Jubilee Week" in Grand Rapids. Left to right, standing, Thomas Henner, second vice president; P. A. Waalkes, president; Donald Smith, first vice president, all of the Grand Rapids Branch; and Chester G. Borlet, third vice president of the National Society AES. Seated, His Honor, Mayor Stanley J. Davis.

GRAND RAPIDS CLIMAXES AES WEEK WITH ANNUAL MEETING AND BANQUET

Grand Rapids Branch added distinction to the GOLDEN JUBILEE of the AES when Mayor Stanley J. Davis of that city proclaimed the week of January 12 to 17 as AMERICAN ELECTROPLATERS' SOCIETY WEEK in Grand Rapids.

The week culminated in the Branch's Twenty-First Annual Educational Session and Dinner-Dance on Saturday, the 17th, at the Pantlind Hotel. At the morning educational session Frederick I. Noble of Lea-Ronal, Inc., presented a paper on High-Speed Copper Plating. The reception accorded Mr. Noble attested to the interest in this excellent presentation.

National Third Vice President Chester G. Borlet, a member and past president of Grand Rapids Branch, was the principal luncheon speaker. Chief Carl Kempe of the Grand Rapids Crime Laboratory talked on "Scientific Aids in Crime Detection" at that same luncheon.

The evening's banquet, followed by dancing, proved to be a delightful ending to a profitable and enjoyable day for the members and guests.

Donald Smith was general chairman. His committee chairmen were: Orville Hoxie, educational; John Dykstra, reservation; Robert Blackford, entertainment; Thomas Henner, publicity; Edwin Krook, program and William Griffin, favors.

(A fuller story, with photographs, will be carried in February PLATING)

PROGRAM

SIXTH INTERIM MEETING, SUPREME SOCIETY

and

DIXIE "GOLDEN JUBILEE" REGIONAL MEETING

AMERICAN ELECTROPLATERS' SOCIETY

DINKLER-PLAZA HOTEL, ATLANTA, GA.

FEBRUARY 13-14, 1959

FEBRUARY 12

8:00 p.m.—Registration, Dixie Regional Group, Hotel Lobby

FEBRUARY 13

8:00 a.m.—Registration, Dixie Regional Group, Hotel Lobby
9:00 a.m.—Executive Board Meeting, Executive Secretary's Suite (All Day)
9:00 a.m.—Plant Tour, Dixie Regional Group—(Lockheed Aircraft Corporation, Georgia Division)
1:30 p.m.—Opening Session, Dixie Regional Meeting, Plaza B Room
2:00 p.m.—Educational Session "A", Dixie Regional Group, Plaza B Room
8:00 p.m.—Joint Meeting, AES Executive Board and Board of Trustees, Metal Finishing Suppliers' Association, Executive Secretary's Suite

FEBRUARY 14

8:00 a.m.—Registration, Dixie Regional Group, Hotel Lobby
8:00 a.m.—Registration, AES Delegates/Alternates, Plaza B
9:00 a.m.—Educational Session "B", Dixie Regional Group, Rainbow Roof
10:00 a.m.—Sixth Interim Meeting, AES Supreme Society, Plaza B
12:00 noon—Luncheon, Delegates/Alternates, Sky Room
1:00 p.m.—Sixth Interim Meeting, AES Supreme Society, Plaza B
2:00 p.m.—Annual Meeting, Dixie Regional Delegates, Forsyth Room
6:30 p.m.—Reception, Dixie Regional Group, Sky Room
7:30 p.m.—Golden Jubilee Banquet, Dixie Regional Group, Rainbow Roof

FEBRUARY 15

9:00 a.m.—Executive Board Meeting, Executive Secretary's Suite.

HOST: AES
DIXIE REGIONAL GROUP

INTERIM MEETING REPORTER

DINKLER-PLAZA HOTEL
ATLANTA, GEORGIA
FEBRUARY 14, 1959

AGENDA
SIXTH INTERIM MEETING AES SUPREME SOCIETY

DINKLER-PLAZA HOTEL
ATLANTA, GEORGIA
FEBRUARY 14, 1959

1. **Roll Call**
2. **Welcome by the Dixie Regional Group**
3. **Welcome by the National President**
4. **Opening of the Session as an Interim Meeting**
   Purpose of the meeting as a sounding board on matters for subsequent consideration and action by the Supreme Society at its Annual Meeting in Detroit, June 18, 1959
5. **Progress and Status Reports:**
   Financial by President
   Educational by First Vice President
   Membership by Second Vice President
   Constitutional Bylaw Amendments by Third Vice President
   Honorary, Merit and Achievement Awards by Past President
   Headquarters and Publishing by National Executive Secretary
   GOLDEN JUBILEE:
   a) Convention by General Chairman
   b) Exposition by Exposition Chairman
   c) International Conference by International Council Chairman
   d) Year-long observance by Executive Secretary
6. **Preliminary Reports:**
   a) Appraisal Committee as to the Need for a Long-Range Planning Committee
   b) Appraisal Committee as to the Need for a Convention Planning Committee
7. **Comments and Questions from the Floor**
   a) Membership Promotion (Membership Committee Chairman, Discussion Leader)
   b) Educational Program including Organic Finishing (Education Committee Chairman, Discussion Leader)
   c) Publications Program (Publications Committee Chairman, Discussion Leader)
   d) Research Program (Research Committee Chairman, Discussion Leader)
8. **Consideration of AES's Per-Capita Tax Structure**
9. **New Business Brought for Discussion by Delegates**
10. **Announcement of Candidates for Third Vice Presidency**
11. **Adjournment**

FREDERICK FULFORTH
Coordinator

AES Past President Frederick Fulforth formerly of the Philadelphia Branch and still an Honorary Member of that Branch, now a Delegate and Honorary Member of the Southeastern Branch is serving as coordinator in Dixie group and Sixth Interim Meeting arrangements.

DIXIE TO WELCOME AES's MIDWINTER GOLDEN JUBILEE MEETING IN SOUTHLAND

At the Dinkler-Plaza in historic Atlanta, one of the South's most esteemed hotels, Dixie is ready to welcome not only a large number of AES members residing in our Southland expected to attend the Dixie Regional GOLDEN JUBILEE Educational Sessions and Banquet scheduled to be held there February 13–14, 1959, but also a record number of AES accredited Delegates and Alternates composing the Supreme Society, AES's highest government body, that will sit in midwinter SIXTH INTERIM MEETING at the same hotel Saturday, February 14.

The heralded two-day GOLDEN JUBILEE event will make its debut with a plant tour of the famed Georgia Division of the Lockheed Aircraft Corporation starting at 9 a.m. Friday, February 13. The Opening Session will take place at 1:30 p.m. that same day, and after appropriate ceremonies will be followed by the first of two Educational Sessions.

That same evening, the AES's Executive Board, having already been in all-day executive session, will meet informally with the Board of Trustees of the Metal Finishing Suppliers' Association.

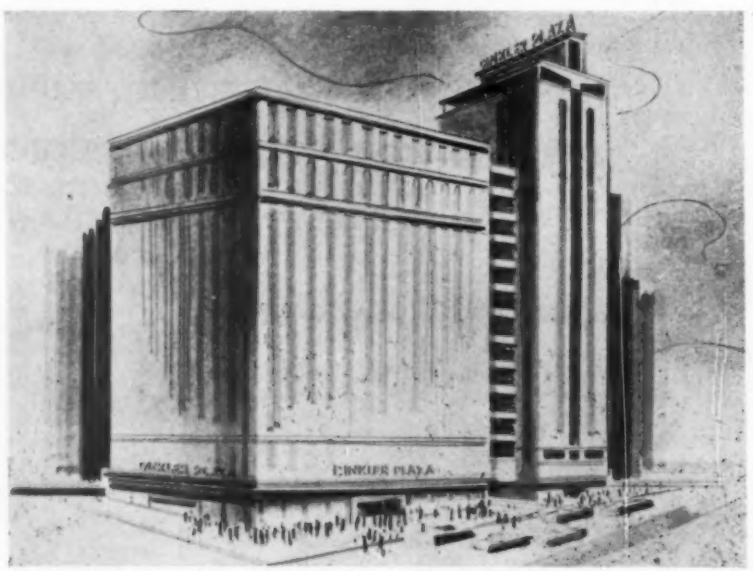
On Saturday, February 14, following a full day's meeting of the Supreme Society during which educational sessions will be the fare for non-Delegates and an imaginative program for the ladies, the assembly will be guests of the Dixie Group at a reception. A gala farewell GOLDEN JUBILEE banquet, program, floor show and dance will terminate AES's two-day visit in our hospitable Southland.

Youngest of the AES's five regional organizations into which 26 of its 58 chartered Branches are already grouped, the Dixie Group is composed of the Southeastern, Miami and Blue Ridge Branches. Southeastern entered the AES family in 1947; Miami in 1957; Blue Ridge in 1958.

TOP TECHNICAL SPEAKERS AT DIXIE REGIONAL

Four prominent speakers will be featured at the two Educational Sessions highpointing the concurrent Sixth Interim Meeting and First Dixie Regional Educational Sessions and Banquet that will be held at the Dinkler Plaza Hotel, Atlanta, Georgia, February 13–14, 1959.

Dr. Abner Brenner, National Bureau of Standards, will present an illustrated talk based on his trip to the Moscow Conference on Corrosion and Protection of Metals. R. T. Gore, Metal & Thermit Company, will present a paper on Alloy Plating. Dr. Harold J. Wiesner, Bendix Aviation Corporation, will discuss Hard Anodizing of Aircraft Fuel Metering Components. James D. Thomas, General Motors Corp., vice chairman of the AES Research Committee, has chosen as his theme Durability of Plating and will discuss the seven active AES Research Projects.



Dinkler-Plaza Hotel in Atlanta will be scene of Sixth Interim Meeting and Dixie Regional, February 13–14., a midwinter feature of AES's Fiftieth Anniversary.

TENTATIVE PROGRAM

GOLDEN JUBILEE CONVENTION AND INDUSTRIAL FINISHING EXPOSITION
AMERICAN ELECTROPLATERS' SOCIETY, INC.

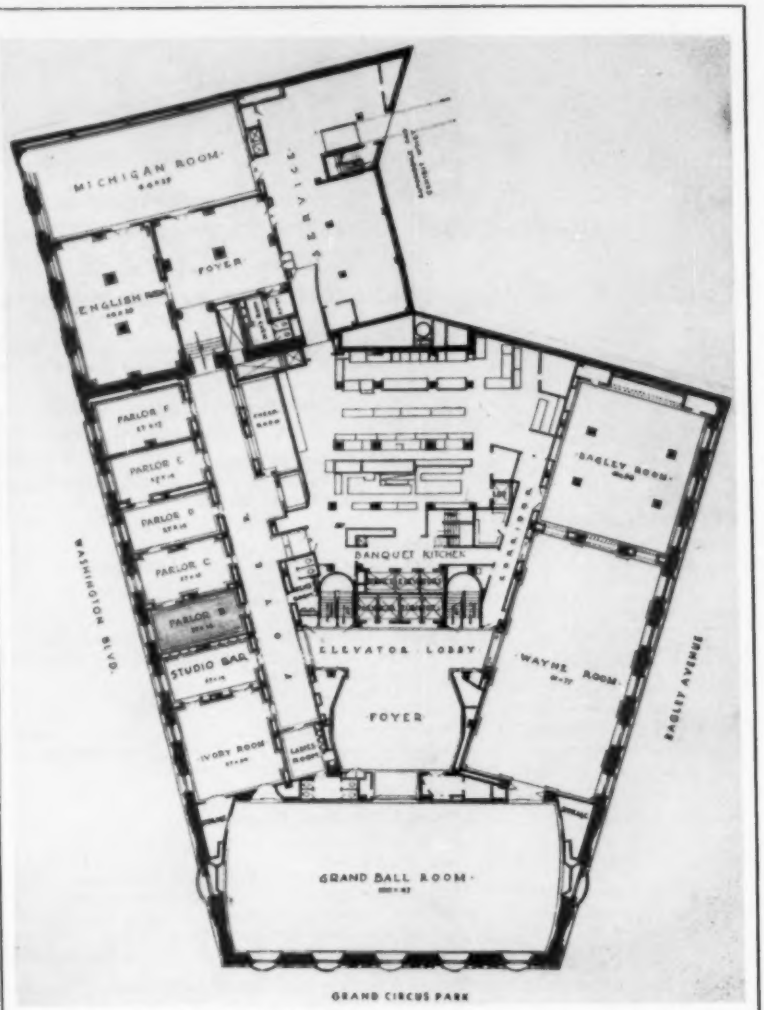
HOTEL STATLER-HILTON, DETROIT, AND ARTILLERY ARMORY, OAK PARK, MICHIGAN
JUNE 15-19, 1959

This is a TENTATIVE PROGRAM as of January 1, 1959. Additions and modifications will be made monthly until finalized

SUNDAY, JUNE 14		
9:00 a.m.	Executive Board Meeting (All Day)	Hq. Room (Parlor B)
1:00–8:00 p.m.	Registration	Foyer
3:00–5:00 p.m.	Ladies Tea	English Room
4:00 p.m.	Credentials Committee Meeting	Parlor B
4:00 p.m.	AES Scientific Achievement Award Committee Meeting	Parlor F
8:00 p.m.	Golden Jubilee Get-Together Party	Grand Ballroom
MONDAY, JUNE 15		
9:00 a.m.–5:00 p.m.	Registration	Foyer
10:00 a.m.	Grand Opening, Golden Jubilee Convention	Grand Ballroom
11:00 a.m.	Business Meeting, Supreme Society	Grand Ballroom
12:00 noon	Branch Secretaries' Luncheon	English Room
12:00 noon	Speakers' Luncheon	Parlor E
2:00 p.m.	Opening Educational Session A, Fifth International Conference on Electrodeposition and Metal Finishing	Grand Ballroom
2:30 p.m.	Editorial Board Meeting	Parlor E
4:30 p.m.	Order of Past Presidents, Business Meeting	(To be announced)
6:30 p.m.	Past Presidents' Dinner	(To be announced)
7:00–9:00 p.m.	Registration	Foyer
9:00 p.m.	AES Golden Jubilee Open House (Sponsored by Metal Finishing Suppliers Association)	Sheraton-Cadillac Ballroom
TUESDAY, JUNE 16		
8:00 a.m.	Research Committee Breakfast	Parlor F
8:00 a.m.	Speakers' Breakfast	(To be announced)
9:00 a.m.–12:00 noon	Registration	Foyer
9:00 a.m.	Educational Session B, International Conference	Grand Ballroom
9:00 a.m.	Educational Session C, International Conference	Michigan Room
9:00 a.m.	Research Committee Meeting	Parlor F
9:00 a.m.	Educational Committee Meeting	Parlor E
9:30 a.m.	Plant Visit, Ford Motor Company (Rouge Plant), Dearborn, Michigan	Bus from Statler-Hilton
10:00 a.m.–9:00 p.m.	Industrial Finishing Exposition	Artillery Armory
12:00 noon	Branch Librarians' and Educational Committee Luncheon	English Room
12:00 noon	Speakers' Luncheon	(To be announced)
2:00 p.m.	Opening Ceremony, Fifth Industrial Finishing Exposition	Artillery Armory
2:00 p.m.	Research Committee Meeting	Parlor F
2:30 p.m.	Educational Session D, International Conference	Artillery Armory
WEDNESDAY, JUNE 17		
8:00 a.m.	Membership Committee Breakfast	Parlor F
8:00 a.m.	Speakers' Breakfast	Parlor E
9:00 a.m.–12:00 noon	Registration	Foyer
9:00 a.m.	Public Relations Committee Meeting	English Room
9:00 a.m.	Membership Committee Meeting	Parlor F
9:00 a.m.	Educational Session E, International Conference	Grand Ballroom
9:00 a.m.	Educational Session F, International Conference	Michigan Room
10:00 a.m.–9:00 p.m.	Industrial Finishing Exposition	Artillery Armory
4:00 p.m.	Golden Jubilee Outing	Artillery Armory Grounds
THURSDAY, JUNE 18		
8:00 a.m.	Speakers' Breakfast	Parlor F
9:00 a.m.–12:00 noon	Registration	Foyer
9:00 a.m.	Business Meeting, Supreme Society	Michigan Room
9:00 a.m.	Educational Session G, International Conference	Grand Ballroom
9:00 a.m.	Plant Visit, General Motors Technical Center, Warren, Michigan	Bus from Statler-Hilton
10:00 a.m.–4:00 p.m.	Industrial Finishing Exposition	Artillery Armory
12:00 noon	Speakers' Luncheon	Parlor F
2:00 p.m.	Business Meeting, Supreme Society	Michigan Room
2:30 p.m.	Educational Session H, International Conference	Grand Ballroom
7:00 p.m.	Golden Jubilee Banquet, Floor Show and Dance	Statler-Hilton
FRIDAY, JUNE 19		
8:00 a.m.	President's Breakfast (National Officers and Wives)	President's Suite
8:00 a.m.	Speakers' Breakfast	Parlor F
9:00 a.m.	Executive Board Meeting	Parlor B
9:00 a.m.	Educational Session I, International Conference	Michigan Room
9:00 a.m.	Educational Session J, International Conference	Grand Ballroom
10:00 a.m.–6:00 p.m.	Industrial Finishing Exposition	Artillery Armory
12:00 noon	Speakers' Luncheon	Parlor F
2:30 p.m.	Educational Session K, International Conference	Artillery Armory

EXHIBITORS
AES INDUSTRIAL FINISHING EXPOSITION
(As of December 3, 1958)

Abbey Process Automation, Inc.
Abrado Finish Corporation
Acme Manufacturing Company
Allied Research Products, Inc.
American Air Filter Company, Inc.
American Buff Company
American Metal Climax, Inc.
American Smelting & Refining Company
Automation Services, Inc., Hydra-Blast Mfg. Div.
Automotive Rubber Company, Inc.
Battelle Development Corporation
Beacon Supply Company
Bison Corporation
G. S. Blakeslee & Company
Branson Ultrasonic Company
Bruce Products Corporation
Buckingham Products Company
Canadian Hanson & Van Winkle Company, Ltd.
The Carborundum Company
Casalbi Company, Globe Div.
Chandeysson Electric Company
The Chemical Corporation
Circo Equipment Company
Clementine, Ltd.
Cleveland Process Company
Clifford Rockwell Company
Conversion Chemical Corporation
Delic Metachemical
Davies Supply & Manufacturing Company
Dean Products, Inc.
Dearing, Milliken & Company, Inc.
Detrex Chemical Industries
Dow Chemical Company
E. I. Du Pont de Nemours & Company, Inc.
Eaton Chemical & Dyestuff Company
Electronic Rectifiers, Inc.
Enthone, Inc. (Subsidiary, Amer. Smelt. & Ref. Co.)
Federated Metals Div., Amer. Smelt. and Ref. Co.
Finish Engineering Company, Inc.
Formax Manufacturing Corporation
G. S. Equipment Company
G. S. Plastic Company
Garfield Buff
General Chemical Div., Allied Chem. & Dye Corp.
Glo-Quartz Electric Heater Company
Grav-I-Flo Corporation
Hammond Machinery Builders, Inc.
Hanson-Van Winkle-Munning Company
Hardwood Line Manufacturing Company
The Harshaw Chemical Company
Haviland Products Company
Heatbath Corporation
Hall Process Equipment Corporation
R. O. Hull & Company, Inc.
Hydra-Blast Manufacturing Division
Industrial Filter & Pump Mfg. Company
Industrial Finishing, Practical Publications, Inc.
Industrial Instruments, Inc.
International Nickel Company
Kocour Company
Kraft Chemical Company, Inc.
Kushner Electroplating School
Lasalco, Inc.
The Lea Manufacturing Company
Lea-Ronal, Inc.
R. W. Legler Plating Works
Arthur H. Lessy Company
MacDermid Incorporated
Manpro Corporation
McAleer Manufacturing Corporation
McGean Chemical Company
Metal & Thermit Corporation
Michigan Buff Company, Inc.
Michigan Chrome & Chemical Company
Minnesota Mining & Manufacturing Company
Murray-Way Corporation
National Association of Metal Finishers
Nordson Corporation
Oakite Products, Inc.
Pennsalt Chemicals Company
Phillips Manufacturing Company
Pockrandt, Inc.
Precision Metal Molding
Rampe Manufacturing Company
Ransburg Electro-Coating Corporation
Rapid Electric Company
Reynolds Metals Company
Robe, Inc.
S & C Manufacturing Company
Schaffner Manufacturing Company
Sel-Rex Precious Metals, Inc.
Service Screw Products Company
J. J. Siefen Company
Siefen Compounds, Inc.
Smoothex Company
Solventol Chemical Products, Inc.
Sparkler Manufacturing Company
Standard Electrical Tool
Frederic B. Stevens, Inc.
F. J. Stokes Company
The Stutz Company
Techline Division, Wheelabrator Corporation
Technic, Inc.
Ther Electric & Machine Works
Tranter Manufacturing Company
Turco Products, Inc.
The Udylite Corporation
Unit Process Assembly
The U. S. Stoneware Company
Universal Tumbling Supply
Univertical Foundry & Machine Company
Vanton Pump & Equipment Corporation
A. T. Wagner Company
Wayne Industries
Westinghouse Electric Corporation
Wyandotte Chemicals Corporation



Plan of the floor of the Statler-Hilton Hotel where most of the convention activities will be held. Shaded area is AES Headquarters Room.

DETROIT READYING RECORD GOLDEN JUBILEE CONVENTION AND EXHIBITION

Estimates as AES crossed the threshold of 1959, its FIFTIETH ANNIVERSARY year, prophecy that its Golden Jubilee Convention, terminal and climax of its Anniversary program, will draw the largest assembly of AES members and their families and guests, plus a host of scientists and visitors from near and distant places, in its long history. These will enjoy outstanding educational and relaxational fare, including conducted tours of four of the motor kingdom's famed industrial plants.

Its Industrial Finishing Exposition is expected to marshal the largest number of industrial exhibitors in this field's lifetime, and these will display current equipment and up-to-date processes before AES's largest exposition traffic. Already required by demand to be enlarged, the Exposition's planned floor space aggregating, as this is written, nearly 36,000 square feet is being sold at a rapid rate. As at December 3, 1958, fully 75 per cent thereof had already been disposed. Among exposition features will be the FIFTIETH ANNIVERSARY LOUNGE of the AES itself and its PLATING MAGAZINE and Research Program.

The Society's Fifth International Conference on Electrodeposition and Metal Finishing, educational sessions phase of its GOLDEN JUBILEE Convention is expected to offer eleven sessions featuring technical and scientific papers presented by authorities from at least nine countries, including the United States, England, France, Germany, Canada, Switzerland, Holland, Italy and India, probably plus Australia and even Russia.

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Have you tried LEAROK...compositions with "no free grease" designed primarily for buffing or coloring pieces which involve cleaning difficulties; does not pack up in recesses and ornamentations. Write today for technical data on the Lea Finishing Products.

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Lea Mfg. Company of Canada, Ltd., 1236 Birchmount Road, Scarborough, Ontario, Canada
Lea Mfg. Company of England, Ltd., Buxton, England
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A LEA-RONAL ANNOUNCEMENT

If you are plating gold—particularly for industrial purposes in connection with electronics or electrical parts where physical characteristics are of extreme importance—investigate the new but well-proved Lea-Ronal Auro Glo Process. It offers:

- **bright deposits for all thicknesses of plate. Auro Glo deposits do not merely duplicate the brightness of the metal as do conventional bright cyanide golds but rather 'build' brightness.**
- **wide bright plating range (0-50ASF) permitting trouble-free rapid deposits.**
- **24 Karat or alloy deposits.**
- **3 to 4 times greater hardness yet with far more ductility than deposits from conventional cyanide bright gold.**
- **heavy build up with electro-formed deposits that are mechanically workable.**
- **greater economy because through exceptional hardness and wear resistance, thinner deposits are permissible.**
- **dense, porosity-free deposits, passing all tests of major electronics parts manufacturing.**
- **no spotting out or bleeding out even at elevated temperatures or prolonged storage.**
- **exceptionally stable bath; simple to use.**

And for those interested in gold for decorative use, Auro Glo offers for the first time Hamilton Shades in a gold for heavy deposits.

As with all Lea-Ronal developments, Auro Glo has been production-tested for well over a year prior to this announcement. It is the superior gold plating formulation. If you electroplate gold, test the Auro Glo process.

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GET *ALL* THE ANSWERS TO *YOUR* FINISHING PROBLEMS

at the
FIFTH INDUSTRIAL FINISHING EXPOSITION!

(Held in conjunction with the
GOLDEN JUBILEE CONVENTION
of the
AMERICAN ELECTROPLATERS' SOCIETY)

The finishing experts will all be under one roof next June. In Detroit, at the Detroit Artillery Armory, from June 15 to 19, at the Fifth Industrial Finishing Exposition!

Take your problems to them. Get expert help . . . at the largest display of finishing equipment, materials and processes ever assembled under one roof.

Make a list of your plating problems. Take it to Detroit with you. See the men who man the booths. The experts with professional, up-to-date help for you. They'll be there to demonstrate the right way to solve your problems.

If you want more information on the Fifth Industrial Finishing Exposition *now*, ask the exposition chairman: • • • • • • • • • •

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DETROIT 7, MICHIGAN

◄ INDICATE B 202.

INTERSOCIETY NEWS

NAMF DRIVE NETS 77 NEW MEMBERS

The first year-long campaign for new members of the National Association of Metal Finishers was concluded last month with a total of 77 new members signed up. The overall membership total of the three-year-old job shop management's group now stands close to 350. This announcement was made this month by drive chairman A. T. Leonard, president of Superior Plating, Inc., Minneapolis, Minn.

Individual honors went to the following division leaders who spearheaded the membership effort in their areas: Harold E. Coombes and Tony Stabile, So. California; Edward N. Marlette, Western N. Y.; Robert Edwards, Ontario, Canada; and Mariano Ranno, Mid-Atlantic States.

Top enrollments among affiliates included Metal Finishing Association of So. California, 17; NAMF of Western N. Y., 9; Ontario Association of Metal Finishers, 8; and Philadelphia Association of Metal Finishers, 8.

Chairman Leonard praised drive leaders for their "untiring efforts."

In his final report to campaign leaders, Mr. Leonard emphasized that the NAMF "challenge lies not only in signing up additional members, which is important, but in keeping our present members satisfied—locally and internationally—through more services, management aids, and by policing our industry constantly . . ."

WESTERN METAL EXPOSITION IN LOS ANGELES, MAR. 16

Hundreds of outstanding metal firms have arranged to display their products, equipment and technique at the 11th Western Metal Exposition March 16–20 in Pan-Pacific Auditorium, Los Angeles.

More than 85 per cent of the display areas have been assigned, states Chester L. Wells, ASM's expositions manager.

Technical sessions will be held by American Society for Metals, American Welding Society, Society for Nondestructive Testing and Metals Branch—Southern Section, American Institute of Mining, Metallurgical and Petroleum Engineers.

Congress programs will contain new developments in metallurgical processes achieved over the past two years.

ASTM COMMITTEE D-19 ON INDUSTRIAL WATER MEETS

The American Society for Testing Materials' Committee D-19 on Industrial Water held its winter meeting at the General Oglethorpe Hotel in Savannah, Ga., Jan. 26–28. The purpose of the meeting was to bring together and discuss the committee work through 1958 and to make preparations for completion of its report to be published at the time of the ASTM Annual Meeting in June of 1959.

Committee D-19 on Industrial Water concerns itself with water as an engineering material and works toward the standardization of terminology and methods of sampling, analysis, and corrosivity tests of industrial water and industrial waste water and water-formed deposits.

DESIGN ENGINEERING SHOW SLATED FOR PHILADELPHIA

The Design Engineering Show, the exposition devoted to research and development, will return to Philadelphia, where the first show was held in 1956. It is scheduled for Convention Hall, in Philadelphia, May 25 to 28, inclusive.

The show has had a tremendous growth in its first three years and is now one of the largest industrial annual expositions in the country. About 400 companies are expected to exhibit.

Coinciding with the show, the fourth annual Design Engineering Conference also will be held at Convention Hall. The conference is sponsored by the machine design division of the American Society of Mechanical Engineers.

Exhibits, which are prepared to aid in the designing of new end products, include mechanical components, power transmission equipment, electrical and electronic components, metals, non-metallic materials, fasteners and adhesives, finishes and coatings, shapes and forms, hydraulic and pneumatic components, and various engineering equipment and services.

Advance registration cards, conference programs and hotel information may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

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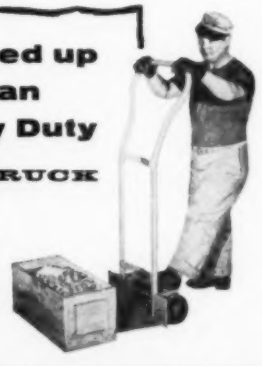
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4529 W. Lake St., Chicago 24, Illinois

ARTICLE REFERENCES

By
WILLIAM TUCKER
Eastman Kodak
Rochester, N.Y.

Most of the articles listed here may be obtained by writing to the publications in which the articles were published. Addresses are given at the end of the references for the reader's convenience.

Photostat or microfilm copies of articles in available magazines may be obtained from: Library of Congress, Washington, D. C.; New York Public Library, New York; Engineering Societies' Library, New York, at prevailing rates. In other cases, consult Wilson's Union List of Serials at your nearest public library for other sources of these articles.

17. ANALYSIS

a. IRON ANALYSIS IN CHROMIUM SOLUTIONS.
A. Salka.
Metal Finishing, *56*, No. 12, December 1958, p. 64.

18. COATING (VACUUM)

a. VACUUM DEPOSITED COATINGS TODAY.
Products Finishing, December 1958, pp. 70–78. Staff Report.

19. CORROSION

a. COATINGS VERSUS CORROSION.
Products Finishing, December 1958, pp. 60–68. (The Third Annual North Central Regional Conference of the National Association of Corrosion Engineers included two symposia of interest to the finishing industry. About 200 corrosion engineers who attended the Cincinnati meeting, held October 15–17, had the opportunity to hear authorities on organic and inorganic coatings speak on their specialties. Summaries of these papers are presented). Staff Report.

b. EFFECT OF INCREASING THE AREA OF IRON TO ZINC ON THE RATE OF REVERSAL OF POTENTIAL IN A ZINC-IRON SYSTEM.
Henry L. Shuldener and Leo Lehrman.
Corrosion, *14*, No. 12, December 1958, p. 17.

c. CORROSION PROPERTIES OF TANTALUM, COLUMBIUM, MOLYBDENUM AND TUNGSTEN.
Clifford A. Hampel.
Corrosion, *14*, No. 12, December 1958, pp. 29–32.

20. ENGINEERING

a. NEW PORTABLE PRECIOUS METALS SOLUTION FILTER CLAIMS TO BE LEAK-PROOF.
Plating Management, December 1958, p. 14.

b. HOW TO ENGINEER AN AUTOMATIC PLATING INSTALLATION.
Fred G. Brune.
Products Finishing, December 1958, pp. 30–39.

21. FINISHING

a. POLISHING AND BUFFING OF ALUMINUM.
Lamont J. Benson.
Metal Finishing, *56*, No. 12, December 1958, pp. 44–45, 50.

22. MISCELLANEOUS

a. FINISHING ZINC BASE DIE CASTINGS.
Lester Spencer.
Metal Finishing, *56*, No. 12, December 1958, pp. 56–59, 63.

b. SCIENCE FOR ELECTROPLATERS. AMINES.
L. Serota.
Metal Finishing, *56*, No. 12, December, pp. 66–69.

23. NICKEL

a. EFFECTS OF IMPURITIES IN A BRIGHT NICKEL BATH ON THE COVERING POWER OF A CHROMIUM BATH.
Robert H. Rousselot and Georges E. Rousselot.
Metal Finishing, *56*, No. 12, December 1958, pp. 46–50.

24. ORGANICS

a. AUTOMATION PAINTING IN RUSSIAN MACHINE TOOL MANUFACTURING.
A. J. Steiger.
Metal Finishing, *56*, No. 12, December 1958, pp. 51–53, 55.

b. IMPROVING YOUR WRINKLE PAINTING.
Harold D. Kaiser and Thomas G. O'Brien.
Products Finishing, December 1958, pp. 24–29.

c. TESTING FINISHES FOR THE FUTURE.
Products Finishing, December 1958, pp. 40–46.

25. SAFETY

a. PLAY IT SAFE WITH DEGREASING OPERATIONS.
Henry Allen.
American Machinist, *102*, No. 25, December 1, 1958, p. 108.

26. STRIPPING

a. STRIPPING METALLIC COATINGS.
J. B. Mohler.
Metal Finishing, *56*, No. 12, December 1958, pp. 60–63.

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INDUSTRY NEWS

TWO DECADES WITH OAKITE'S AUNT ELLA

For over two decades, a double-talking "Aunt Ella" has been delighting the womenfolk of AES at a ladies' party that has been a bright feature of each of the Society's Annual Conventions over that long span.

In the guise of brash "Aunt Ella," an executive of a prominent industrial company serving electroplaters and metal finishers as a source of supply, has been entertaining AES ladies, through those years, at a special convention event featuring magic, storytelling and audience-participation antics.

Throughout AES, that "Aunt Ella" name is synonymous with "David X. Clarin"—and "Dave," as he is widely known, is Division Manager of Oakite Products, Inc., itself observing its Fiftieth Anniversary in 1909, birthyear too of AES.

A native Briton, "Aunt Ella" or "Dave" (take your pick) came to Oakite nearly 39

David X. Clarin

years ago. While attending the AES's Milwaukee Convention in 1938, he conceived the idea of doing something special for AES ladies while their menfolk were so occupied with educational enrichment at AES annual conventions. An amateur magician, raconteur and group entertainment leader, "Dave" created the so-called "Aunt Ella Society" there and then, and the first informal "Aunt Ella" party occurred spontaneously in Oakite's hospitality room at that 1938 Annual Convention. It recurred at the Asbury Park Convention in 1939—at Dayton in 1940—at Boston in 1941.

Corner of Oakite's modern 30,000 sq ft laboratory.

Then in 1942, at the Grand Rapids Convention, "Dave's" idea flourished into the first formal "Aunt Ella Luncheon," a successful event held at the Women's Club of that municipality with some 100 AES ladies present. "Thereafter," Dave recounts, "like Topsy, it grew and grew and grew until in recent years, we have run from about 325 to 400 ladies present".

First large-scale convention entertainment sponsored by an industrial company supplier exclusively for AES ladies, the Clarin event has served AES for a score of years. As AES observes its Golden Jubilee, it extends hearty thanks to "Aunt Ella," "Dave" and Oakite for the hours of pleasure that they have thus afforded some twenty AES National Conventions.

OAKITE ATTAINS HALF-CENTURY

Continuing research and in-plant service are essential to progress in industrial cleaning, according to Oakite Products, Inc., celebrating its 50th anniversary this month.

It was research that gave David C. Ball the idea that led to the founding, in February 1909, of the Oakley Chemical Co. Cleaning in those days was done mostly by saponification, or the conversion of soils to water soluble soaps. Animal and vegetable fats, the major components of the soils of the time, responded readily to saponification, and cleaning was not of critical importance. Great strides were being made in machinery, food processing, and metal finishing, however: cleaning was becoming critical. And, with the development of the petroleum industry, soils which could not be saponified were beginning to present problems.

Emulsification—loosening the bonds between surface and soil, and suspending the soil in solution—was the answer. That was the peculiar ability of the company's first product, Oakite, the forerunner of today's detergents. The company even then recognized that there was no universal cleaner, however, and soon other products were added to meet the demands of industry. Research continued at an ever increasing pace, spurred on by new metals, new products, new methods of processing, and the new soils they created, as well as by the increasing awareness of the importance of cleaning.

Today, Oakite's family of cleaning compounds and chemical specialties numbers about 150, ranging from pickle control solutions for acid baths in steel processing to phosphate coatings for metals and compounds for decontaminating surfaces subjected to radioactivity.

Oakite's laboratories today occupy 30,000 sq ft of well-equipped space, manned by experienced chemists and technicians. Working in teams, in individual laboratory sections, they cover the field of surface chemistry, developing an average of 12 new products a year. Among those standardized in 1958, after extensive field testing, are a cleaner designed for aluminum aircraft and other transportation equipment; a compound for cleaning baking pans and utensils; a compound designed to speed the removal of acrylic and epoxy resin finishes; an electrocleaner for steel; a lubricant for metal drawing and forming operations; a pre-plating cleaner for zinc die castings; and a rust-retarding cleaner for steel.

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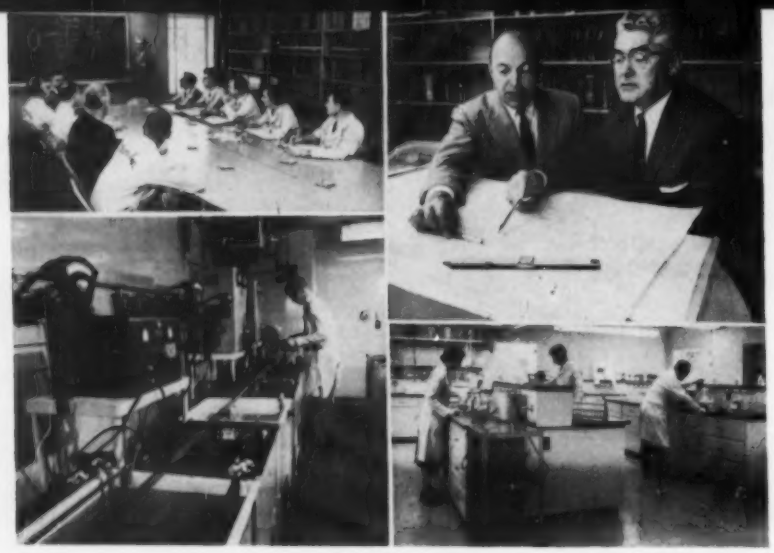


(Top left) Conference room of new Enthone laboratory. Dr. Walter Meyer at blackboard. (Top right) Dr. Walter R. Meyer, Enthone president and technical director, right, and John J. Martin, general manager, equipment department, plan a metal finishing installation. (Lower left) Concealed piping and duct work features of the pilot plant. (Lower right) Evaluating metal finishing compounds. Portable rectifier shown in the foreground.

ENTHONE'S NEW RESEARCH LABORATORY

Enthone, Inc., a subsidiary of American Smelting and Refining Co., has just completed a new research laboratory at its main plant in New Haven, Conn. The laboratory, most modern and well equipped, triples Enthone's research facilities. This increase in space and equipment, together with an enlarged research staff, enables the company to broaden its activities in the development of new, effective metal finishing compounds and metal treating processes.

The three-story air conditioned building provides the Enthone research staff of chemical and metallurgical scientists with a broad range of functional facilities and conveniences. The first floor, is devoted to flexible pilot plant laboratory, the second floor comprises technical service, product evaluation and basic research laboratories, the third floor includes laboratories for specialized research and the main library and conference room.

Equipment includes square wave and ultrasonic generators. The more conventional laboratory equipment has been selected carefully so that a broad spectrum of metal finishing problems can be handled. Rectifiers used for plating experiments have been mounted on wheels so that they can be moved to appropriate bench locations as needed. Special humidity and corrosion testing cabinets, designed by Enthone engineers to duplicate severe climatic conditions, make possible the thorough evaluation of corrosion factors and the merit of various metal finishes.

One of the largest sections is the pilot laboratory. It is set up to closely approximate actual plant operating conditions and will be used to study problems in plating, cleaning, blackening, acid dipping, paint and metal stripping, alkaline derusting and descaling, degreasing, buffing, tumbling, rust and tarnish inhibition.

The pilot plant unit has been designed for efficiency, flexibility and cleanliness. Unlike most such installations, there is no "forest" of pipes and ducts, these are concealed behind or under the tanks. Many structural elements are made of maintenance-free, easy-to-clean plastic. The exhaust ducts, water and air lines and bench tops are fabricated of polyvinyl chloride (PVC). Tanks and drain troughs are lined with PVC. The pilot plant has a plastic-coated cement floor, epoxy-coated walls, and plastic-insulated bus bars.

So that a maximum number of different experiments can be carried through simultaneously, each of the 41 plating tanks has individually controlled rectification and temperature control. Each tank has a capacity of 40 gallons.

In practice, the laboratory will be used in a highly systematized manner to solve the metal finishing problems which are submitted by customers. In most cases the problem solving begins with a conference between the customer and Enthone specialists. At such a conference all aspects of the specific situation, and customer objectives, are examined. With this information in hand, Enthone technologists take the problem into the laboratory. As a first step, the possible application of Enthone's existing metal-treating compounds is evaluated. If any product will not fulfill all needs, a new compound is developed to precisely meet the specific needs posed by the circumstances. Only after all factors have been thoroughly tested, in both the laboratory and pilot plant, and the Enthone researchers are sure that the best possible solution has been found, is the compound sent to the customer for evaluation.

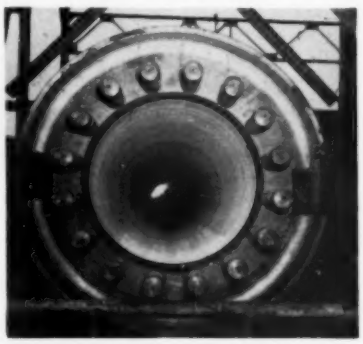
A conference between customer and Enthone staff members when metal finishing problems are faced is designed to make their solving more scientific, was dictated by Dr. Walter R. Meyer. Dr. Meyer, as president and technical director of Enthone, works personally with as many of the research projects as possible.

WORLD'S BIGGEST SILVER-PLATING JOB

Oneida Silversmiths, who have silverplated enough knives, forks and spoons in a single year's time to stretch—end to end—three times the distance from New York to San Francisco, were recently faced with a new and different problem. The Chemical Construction Corp. of New York City requested the silversmiths to silverplate the interior surfaces of two giant autoclaves they were producing for Cyanamid of Canada, Ltd.

The two giant autoclaves each was 44 ft long with an outer diameter of 54 in. Each weighed 110 tons, and they were fitted with two end plugs weighing 2-M tons apiece.

When the first autoclave reached Oneida, the enormity of the plating job



Pure silver deposit on autoclave interior.

was readily apparent. The giant flat car was switched on to one of Oneida's spur tracks. Both car and autoclave were too large to be taken into the factory, so a "tent factory" was erected over the entire operation.

Before plating could begin, Oneida's engineers had to install bearings on the floor of the flat car so that the autoclave could be continuously revolved on the car itself during the plating operation. Then it was necessary to build and check the drive mechanism.

The final silverplating was completed in approximately three months from the time the first autoclave reached Oneida.

Oneida was required to silverplate the autoclaves and end plugs with 999.5 Fine Silver. Approximately 50,000 oz of silver went into the plating solution. At today's current prices the cost of the silver alone for this—the largest silverplating job in the world—was more than $45,000.00.

INDUSTRY NEWS BRIEFS

NEW OXIDE SCALE REMOVER BRINGS AWARD TO DISCOVERER

Development of a new process for removing tough oxide scale from titanium metal parts has brought a $5000 award to Temco Aircraft Corp., Dallas, Texas, Group Engineer John J. Dailey.

The $5000 check was presented to Mr. Dailey in return for full rights to the process discovered by him through metals research in the company's materials and process laboratory.

A patent on the process, called "Ti-Brite", was given Temco in 1957. Temco has granted exclusive licensing rights to the DelChem Division of Pennsalt Chemicals Co., Los Angeles, Calif.

NEW TYPE ION EXCHANGE RESIN

A new ion exchange resin that demonstrates high selectivity for heavy metal cations has been announced by the Dow Chemical Company.

The product is known as Dowex Chelating Resin A-1. It is the first chelating resin to be made commercially available.

The resin can be used in removing traces of heavy metals from a wide range of product streams, and in separating various heavy metals, according to the company.

MRS. WIARDA SUCCEEDS TO PUBLISHING FIRM PRESIDENCY

The directors of Metals and Plastics Publications, Inc., Westwood, N. J., have elected Mrs. Joan Trumbour Wiarda president, succeeding Mrs. Louise H. Langdon, who has resigned because of ill health.

The company, established in 1903, publishes *Metal Finishing* magazine and technical books and directories. Mrs. Wiarda has been associated with the firm since 1923, following graduation from Benedictine Academy, Paterson, N. J. Mrs. Wiarda studied advertising, circulation, merchandising and marketing at Columbia University.

Mrs. Wiarda is the daughter of the late Thomas A. Trumbour, former general manager of the publishing firm. She has been active in the American Electroplaters' Society since 1926 and a member of the National Industrial Advertisers Association since 1936. She is a member of the Women's Advertising Club of Chicago.

Also maintaining offices at 35 East Wacker Drive, Chicago, Mrs. Wiarda travels extensively. She has called on almost every manufacturer and distributor of metal finishing equipment and supplies in the United States and Canada.

In 1954, she attended the International Conference on Electrodeposition in London and visited approximately 40 metal finishing plants in England, Holland, Belgium, France, Italy, Germany and Switzerland. She is co-author of "Finishing in the Heart of Industrial Europe," published in August 1954.

NEW METAL-ALLOYING PROCESS

A new technique that produces metal alloys three to four times as strong as conventional metals at high temperatures has been announced by Denver Research Institute, University of Denver.

The new metal-alloying process—which involves "mixing" ceramic materials with metals—opens the way to improvements in rockets and missiles, jet and internal combustion engines, and innumerable other military and industrial products, according to James P. Blackledge, head of the institute's Metallurgy Division.

Brass Plating Techniques

●

Today's competitive markets require the greatest efficiency possible. Just as modern women have turned to prepacked foods to reduce kitchen labor modern platers have turned to prepacked materials. True Brite offers a complete line of prepacked materials for brass plating. We have solutions and dry compounds with ratios of copper to zinc for all uses. Where particular conditions apply the exact formula necessary can be worked out with our modern knowledge of what makes brass plating solutions tick.

●

Where variation in ratios is a real problem True Brite manufactures both sodium and potassium copper cyanides. These water soluble materials can be mixed with zinc in desired ratio and are useful as well in copper or copper tin plating solutions. As basic manufacturers of copper and zinc cyanides all this convenience is yours at a price you can afford.

●

When you have a problem with brass plating we usually can come up with a solution. If you want high rust resistance the answer is often a zinc plate under the brass plate. Brass plate can be applied directly to steel, zinc diecastings, aluminum and most other metals commonly used by very simple techniques. Both barrel and still tanks can be used.

●

Control of brass plating used to be a difficult problem. Today True Brite has available analytical methods that are dependable and simple. Proper formulas can then be maintained and only outside conditions such as temperature need be watched. True Brite Brass Maintenance Solutions and Compound enable the regular maintenance to further simplify the problems.

●

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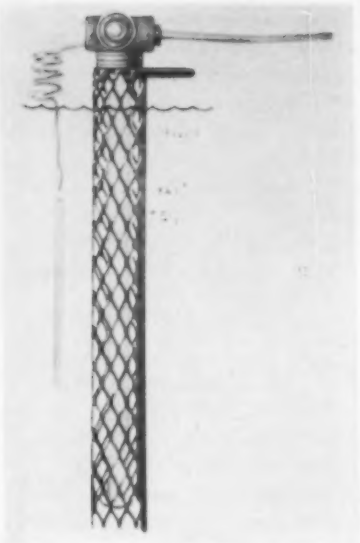


E—200. Immersion Heater—N. J. Thermex Co. Inc., announces Therm-X-Red, a new line of immersion heaters introducing a new vapor venting system to eliminate internal explosion in quartz heaters, called Vapo-Vent. The assembly provides a system for venting expanding gases in a completely liquid sealed head assembly.

In addition Therm-X-Red heaters features the Neo-Tite, a vapor and liquid tight assembly which protects both quartz and steel heater units from damage by accidental total immersion in highly corrosive chemicals.

E—201. Buff Treatment—Designed to protect life and property from the risk of disastrous fires caused by finishing operations, a new safety treatment is announced by American Buff Co., for its entire line of cotton and sisal buffs for every metal finishing need.

This new flameproof treatment is said to positively retard flame. Buffs cannot ignite even when directly exposed to fire, it is claimed. This treatment contributes new savings in operation. Its inherent adhesive texture holds more buffing compound, speeding up cutting and coloring . . . reduces compound consumption, helps hold down production costs.

E—202. Polypropylene Tanks—The first self-supporting tanks fabricated of polypropylene for service at high temperatures have just been announced by the American Agile Corp.

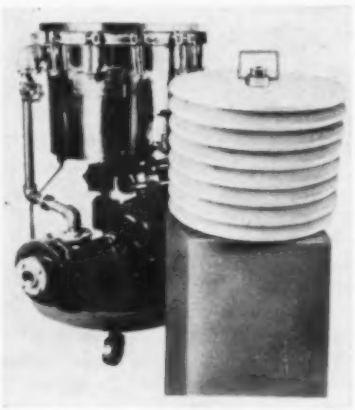
The tanks are of all-welded construction to provide leak-proof design, important for corrosive containing liquids. They have fabricated polypropylene one-inch drain faucets which give an accessible drain outlet.

E—203. Abrasive Belt Hand Tool—The metal industry's first abrasive belt radii finishing hand tool has been developed and marketed by a Michigan tool and die engineer.

The device, simply called the Peterson hand finishing tool by its designer, Arthur Peterson, weighs slightly more than one pound without the small air grinder motor.

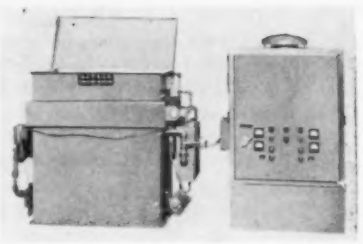
The tool has an unlimited number of applications: tool and die work; spot metal finishing; de-burring and de-edging; machine construction and maintenance; and polishing on lathes and grinders are among some of its uses.

The Peterson tool has three usable sides: the "nose" which is adjustable for large or small radii; the long side used for larger radii and convex surfaces; and the top, used for flat work.



E—204. Filter Cartridge—A new type of filter plate called the "Wash-Off" cartridge for use in standard Sparkler horizontal plate filters has been announced by the Sparkler Mfg. Co.

These "Wash-Off" plates are assembled as a removable cartridge similar to the standard horizontal plate type, but when removed for cleaning it is not necessary to disassemble each plate to remove the spent cake and filter paper to prepare for replacement. The complete plate cartridge can be cleaned as a unit and returned to the tank for use in a fraction of the time required to clean individual plates.



E—205. Sonic Degreaser—The new Detrex 1288 Soniclean degreaser, with the use of high frequency (400 kc) and stabilized trichlorethylene, is said to condition work to sufficient cleanliness that inspection under a high-power wide field binocular microscope will discern no soil.

With the addition of adequate quantities of clean distillate, augmented by 2 micron filtration of the Sonic chamber, this process is said to provide a production cleaning method eliminating tedious and costly hand cleaning.

E—206. Spray Wash Cleaners—Cleaners SW-57 and SW-58, powdered alkaline materials for use in pressure spray washing machines, have been introduced by Enthone, subsidiary of American Smelting and Refining Co. The two new products are said to contain surfactants designed to give maximum detergency with a minimum of foam. They remove oil, solid dirt and other shop soils. Cleaner SW-57 is mild in alkalinity and claimed to be safe for use on reactive metals such as zinc and aluminum. Cleaner SW-58 is designed for cleaning steel, cooper, brass and magnesium.

Both cleaners are effective at concentrations of 1–4 oz/gal and at temperatures of 150–200F. They can be used in all types of spray washing machines or for tank applications using various types of agitation. For most applications, either Cleaner SW-57 or Cleaner SW-58 alone will do the cleaning job; for buffing compound removal, either cleaner, used in the second stage of the washing machine, rapidly removes the emulsion, or solvents remaining on the work from the first or buffing compound removal stage.

E—207. Silicon Power Rectifiers—High current silicon power rectifiers providing dc forward currents up to 250 amp with a maximum peak inverse voltage range from 50 to 500 are currently available from International Rectifier Corp. These units are designed for use at high temperatures and are capable of operation at a junction temperature of 190 C.

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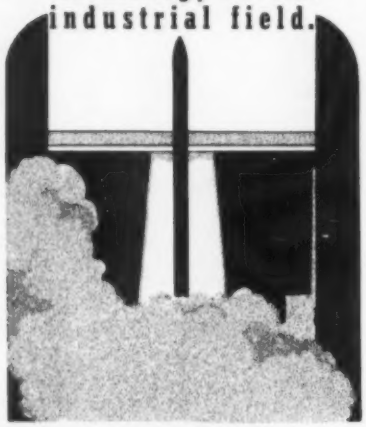

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E—208. Aluminum Etch Cleaner—A new, improved formulation for Etchalume 14, a widely used etching and cleaning compound for aluminum, has been announced by Enthone, Inc., subsidiary of American Smelting and Refining Co. Etchalume 14 is a alkaline material originally designed to etch aluminum rapidly and uniformly without the formation of aluminum hydroxide scale or cake on the work, tanks or heating coils. The newly developed formulation is said to be twice as effective in this respect and, in addition, has longer life.

The new Etchalume 14 is a powdered material which is added to water and can be operated over a wide range of concentrations and temperatures. It is claimed to produce a fine, uniform etch and leaves the surface of the aluminum clean and free from residual, slimy film of aluminum hydroxide. The product contains complexing agents which cause the aluminum dissolved in the bath to precipitate as a loose, flocculent powder rather than as a hard, tenacious scale.

It can be used for cleaning and etching of aluminum prior to plating, anodizing, bright dipping, welding, phosphating and chromate conversion coatings.

E—209. Laboratory Dialyzer—A laboratory dialyzer with acid-resistant membranes is available from Graver Water Conditioning Co. This bench unit is an inexpensive model for all types of separation problems involving electrolytes, large organic molecules and colloidal matter. Like the large Hi-Sep dialyzer of which it is a scaled-down model, the laboratory dialyzer can handle acid liquors, as well as alkali and neutral salt liquors. The unit is made chiefly of plastic. It measures 20 in. high and 15 in. wide.

E—210. Powdered Chromate—Heatbath Corp. introduces another new powdered chromate product known as Duracoat M-2-P for producing blue-bright, stain-resistant finishes on zinc plate at low cost. Only ½ oz of Duracoat M-2-P plus a small amount of nitric acid is required to make up one gal of solution. No leaching is required. Low cost, long life and simple control are the outstanding features claimed for the product.

E—211. Grease Stick—Schaffner Mfg. Co., has developed a new grease stick for the metal finishing industry.

This grease stick, G.S.-7205, is a combination of light-bodied greases that are said to spread easily on the abrasive belt or wheel, prevent logging or clogging, and prolong the time efficiency of each.

It is particularly for slow moving belts or wheels, where there is not enough surface feet per minute to melt conventional type greases.

E—1212. Dial-Cycle Selector—Fifteen or more different production or processing patterns (cycles) are now made optional for every carrier to perform automatically throughout standard Abbey-Matic Systems by pre-setting a single Dial-Cycle Selector on each carrier. It is the latest development of Abbey Process Automation, Inc.

According to the manufacturer, one operator can pre-determine the course of all individual carriers in the system by simply turning the "dial" on each carrier to the proper "number" corresponding to the production or processing pattern desired—or designated by production order. Each pattern (cycle) can include any variety of operations or processes in the system, and can differ radically without conflicting movements, delays, confusion or errors. Cycles can also be altered at any point during processing by appropriate remote re-setting at any chosen moment or altered to new requirements by simple relocating of electromagnetic trippers.

E—213. Powdered Etchant—Kelite Alsite has been developed by Kelite Corp. It is claimed to impart a decorative etch finish to aluminum and aluminum alloys by immersion. The etch hides die marks and some structural imperfections, gives a final decorative finish to aluminum articles, and provides a base for further finishing, such as lacquering, anodizing, chromatizing, or other proprietary aluminum finishes.

A powdered, dustless composition, Kelite Alsite is concentrated and readily soluble in cool or warm water. It exhibits controlled foaming to trap alkali spray, removes light, oily soils and prevents formation of aluminum oxide scale on tank and heater parts.

Available to volume etchant users is Kelite Alsite CX, a concentrated, dustless, powdered additive.

BOOKS

Remittance must accompany all book orders placed with AES Headquarters.

Determination of the Mechanical Properties of Aircraft-Structural Materials at Very High Temperatures After Rapid Heating. by J. B. Preston, W. P. Roe, and J. R. Kattus, Southern Research Institute for Wright Air Development Center, U. S. Air Force. Jan. 1958. 206 pages. Order PB 131664 directly from OTS, U. S. Department of Commerce, Washington 25, D. C., $3.

This report concerns tests into the mechanical properties—tensile, creep, fracture, compression, shear, and bending—of several aircraft and missile structural materials under conditions of moderate to rapid rates of heating and of loading. Test materials included electrolytic-tough-pitch copper, oxygen-free high-conductivity copper, A-nickel, ingot iron, molybdenum, tantalum, Type GBH graphite, and composite OFHC copper plus 316 stainless steel sheet. Temperature ranges from room temperature to the melting points of the metals and to 5750F for the graphite were used, with heating, holding, and loading times to failure ranging from three seconds to 30 minutes. The strength of the metals was found to decrease continuously with increasing temperatures. Graphite, however, increased in strength up to 4500F and then decreased with further increases in temperature. The inherent load-carrying capacities of the metals increased with decreasing times under load, while graphite was not significantly affected by these variations. The data gathered from the results of these and other tests are included in the report, along with descriptions of the test equipment and procedures used.

CLARIFICATION

Certain data included in the paper "What Electroless Nickel Can Do For You" by Robert J. Girard in PLATING, December 1958, which were made available by Dr. G. Gutzeit, are the result of experimental work performed by the laboratory of General American Transportation Corporation. This particularly refers to the material appearing on page 1235 under the subhead "Composition." All of the patents cited on pages 1235 and 1236 are the property of General American Transportation Corporation.

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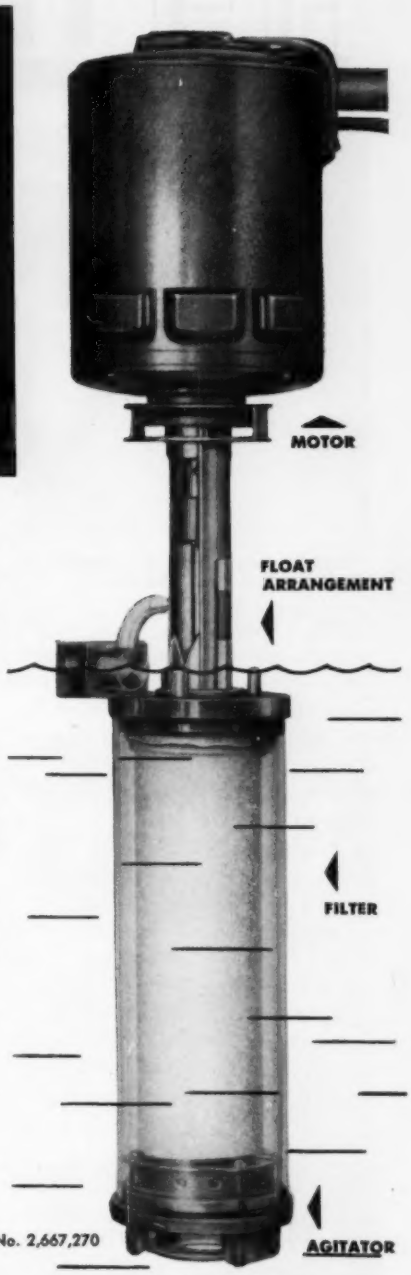

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- ✓ Large Filter Area at Low Cost . . . Easy to Clean
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TRADE LITERATURE

Paint test panels ready for shipping at the Parker Rust Proof laboratory.

L—200. Paint Test Panels—A new brochure entitled "How Parker Builds Quality into Paint Test Panels" has been issued by Parker Rust Proof Co. It describes this firm's phosphate coated test panels and contains illustrations of the production equipment, testing and packaging methods.

L—201. Microhardness Tester—A new, low cost microhardness tester that permits direct, accurate readings, corresponding to Vickers, within 15 sec by measuring resistance hydrostatically and which eliminates a microscope, conversion charts and complicated tables is illustrated and described in a new, two-color bulletin recently issued by Newage Industries, Inc. According to the manufacturer, many production and precision parts that could not be checked before can now be tested with accuracy. The bulletin describes the fact that slight vibrations usually destructive to microscopic readings do not affect the Newage tester and it can be moved from department to department without fear of damage. The compact tester is said to be easily read and easily adjusted to facilitate comparative readings which correspond to Vickers 100 to 1000 (equal to hardnesses ranging from Rockwell B64 to C70 or Knoop 500G, 117–94).

L—202. Silicon Carbide Biographer—A limited number of a new comprehensive bibliography on silicon carbide has been compiled by Kenneth M. Merz of the Research and Development Division of The Carborundum Company.

Prepared in response to numerous requests for information on silicon carbide, it is a 107 page listing of scientific literature on the subject. Authors are listed alphabetically. Subject keys are listed in the forefront and in the margins by each author listing.

L—203. Compressed Air Filters—A new booklet has just been published to describe the complete line of Fulflo filters for compressed air and other gases. It includes several single tube models for operating pressures from below 125 psi up to 4000 psi, and flow rates as high as 800 scfm. Multi-tube models, with as many as 270 honeycomb filter tubes, are designed for high flow rates. Booklet includes technical information and charts on flow characteristics, physical dimensions, and metals in which the filters are made.

How to solve YOUR plating and metal finishing temperature control problems
PARTLOW mercury-actuated temperature controls

L—204. Temperature Control—As accurate and constant temperatures are a necessity in metal finishing operations, particularly in the plating room, the Partlow Corp. has issued a four-page folder on the applications of its temperature controls in this field.

The two-color folder features the newly introduced Partlow pneumatic controls, for the rough tests of plating rooms with their corrosive atmosphere and the need for close tolerances and constant control. They provide an inexpensive throttling type control.

Also described are Partlow electrical controls, both non-indicating, indicating and recording, plus their line of thermally operated gas controls and thermometers.

Used by Platers, Silversmiths, Jewelry Manufacturers, Makers of Watches, Clocks and Electronics and other metal finishers.

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Reply to
Mr. P. M. HENON, S.A. LA NITURATION,
Sclessin, Liege, Belgium.

PATENT ABSTRACTS

DR. D. GARDNER FOULKE
Manager, Electrochemical Development
Hanson-Van Winkle-Munning Co.
Matawan, New Jersey

Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.

No. 2,850,419, 9/2/58—Passivating Silver—J. Melse and P. Baeyens, assignors to North American Philips Co., New York, N. Y.

Silver may be passivated by immersing in a solution of an oxygen compound of hexavalent chromium, more than 5 g/l, and a complex silver ion forming in an amount greater than 1 g/l. The *p*H and free silver ion content are controlled according to a graph attached.

4 claims, figure.

No. 2,850,441, 9/2/58—Displacement of Cadmium on Aluminum—J. Greene and J. Holzwarth, assignors to General Motors Corp., Detroit, Mich.

Deposit cadmium on aluminum by immersing in a solution containing 37 g/l of cadmium chloride ($2\frac{1}{2}$ H_2O) and 40 ml of concentrated hydrochloric acid. To complete bearing, plate babbit on the cadmium.

9 claims.

No. 2,850,448, 9/2/58—Pointing Wire—C. Stricker, assignor to U. S. Steel Corp.

An apparatus for electrolytically pointing wire is described.

5 claims, figure.

No. 2,851,044, 9/9/58—Plating Machine—John Daves, assignor to the Udylite Corp., Detroit, Mich.

A plating conveyor with three descrete, longitudinally alignable track sections with means for moving each vertically.

14 claims, 4 figures.

No. 2,851,375, 9/9/58—Ductile Chromizing—G. Samuel, assignor to Metal Diffusions Inc., Philadelphia, Pa.

To lay down a ductile chromium layer on steel, place the object in a retort with a chromizing composition (a source of chromium and a chromizing catalyst which at elevated temperatures releases hydrogen) heat retort to 1550–1650 F and hold at that temperature for 2 hr. See also No. 2,851,377, by same inventor describing impregnating steel with copper-aluminum in one claim.

1 claim, figure.

No. 2,851,380, 9/9/58—Conductive Ink—W. Berlinghof, assignor to Woodmount Products, Huntington Valley, Pa.

An ink for use in making printing circuits consisting of silver and triallylcyanurate polyester resin is described.

4 claims, figure.

No. 2,851,385, 9/9/58—Process of Coating Aluminum Surfaces—F. Spruance and Nelson Newhard, assignors to Amchem Products, Inc.

A bath for providing a chromate coating on aluminum is described as containing hexavalent chromium and a fluoride compound along with one or more metal ions selected from zirconium, titanium, and tin (IV) in the amount of 0.1 to 7.0 g/l.

2 claims.

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Electro-Glo Company, 621 S. Kolmar Ave., Chicago 24, Ill.

No. 2,851,406, 9/9/58—Electropolishing of Zirconium—E. Bowerman and E. Saubestre, assignors to Sylvania Electric Products Corp., Mass.

An electropolishing electrolyte consisting of hydrochloric and acetic acids is claimed.

7 claims, figure.

No. 2,851,766, 9/16/58—Coating Uranium—A. Gray, assignor to USA (AEC).

Plate the uranium first with chromium then firmly bond with aluminum or aluminum alloys.

8 claims.

No. 2,852,410, 9/16/58—Rack for Hot Dip Galvanizing—R. Brewer-assignor to Republic Steel Corp., Cleveland, Ohio.

A rack made of titanium is claimed for holding article to be hot-dip galvanized for use in carrying the work through the pickle, flux, and molten zinc bath.

1 claim, 3 figures.

No. 2,852,417, 9/16/58—Cleaning Method and Apparatus—T. Kearney, assignor to Detrex Corp., Detroit, Mich.

A degreaser equipped with an ultrasonic zone is claimed.

16 claims, figure.

No. 2,852,447, 9/16/58—Electrodepositing Chromium—J. Hausner, Chicago, Ill.

Chromium as an accelerator for boiling liquids (instead of pumice, pottery, beads, etc.) is deposited at high current densities (120–320 amp/dm^2) with a superimposed high frequency field of the magnitude expressed in wave lengths in air being 1.8 to 1.6 m.

3 claims, figure.

No. 2,852, 449, 9/16/58—Electrodeposition of Nickel—D. Becking and H. Brown, The Udylite Research Corp., Detroit, Mich.

An addition agent for nickel plating in conjunction with sulfo-oxygen compounds is described as a vinyl substituted m-dioxane and a di-vinyl substituted bi(m-dioxane) and derivatives thereof. The amount used is 0.002 to 0.5 g/l.

10 claims

No. 2,852,450, 9/16/58—Copper Plating—E. Mundell, assignor to R. R. Donley and Sons Co., a Delaware Corp.

For plating rotogravure cylinders and the like a copper plating method is claimed wherein an insoluble anode is used (94 per cent Cu, 3 per cent Sn, 3 per cent Sb) and copper is continuously added to the electrolyte as it is plated out.

1 claim, 4 figures.

No. 2,852,452, 9/16/58—Electrolytic Process—G. Cunningham, et. al., assignors to Horizons Incorporated, Princeton, New Jersey.

A process for recovering the values in titaniferous iron ores is claimed.

8 claims.

No. 2,852,455, 9/16/58—Electrolytic Purification of Water—J. Hausner, Chicago, Ill.

To purify water and recover metals therefrom, pass a direct current through the water and superimpose a high frequency field of the magnitude of 2 to 6 expressed in wave lengths in air.

7 claims.

No. 2,853,447, 9/23/58—Electropolishing Apparatus—M. Hackenburg, Gillette, N. J.

A barrel electropolishing apparatus is described.

15 claims, figure.

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PERSONALS

Carel H. Neffenger has been promoted to general sales manager, and **Robert F. Pyle, George D. Stevenson** and **Arthur W. Reckling,** made district sales managers of G. S. Equipment Co., and affiliates, the General Supply Co. and G. S. Plastics Co.

Mr. Neffenger, active in general sales for all three firms since 1953, takes charge of the increased sales administration responsibilities due to recent additions to lines and extended territorial coverage. His office is at the Cleveland Plant.

Mr. Pyle serves West Side Cleveland and Central Ohio areas.

Formerly with Heil Equipment, and more recently with International Plastics, he is experienced in plastics, plating, plant layout and equipment manufacturing.

C. H. Neffenger

R. F. Pyle

G. D. Stevenson

A. W. Reckling

Mr. Stevenson manages district sales in East Side Cleveland, Eastern Ohio, and Western Pennsylvania. He formerly worked for Frederic B. Stevens, and later became a representative for Hoover Ball Bearing, prior to joining G. S. Equipment. They also make their headquarters at the Cleveland Plant.

Mr. Reckling, with headquarters in Detroit and Livonia, Mich., manages district sales for G. S. Equipment and G. S. Plastics in Northwest Ohio, Eastern Indiana, Southern Michigan, and Detroit. He serves jobbers only in the motor city and deals direct with the field in the other areas. Formerly with Sel-Rex Corp. as sales representative, his previous experience was gained coming up through plating ranks at Atlas Plating.

G. E. Pehrson

S. Rothstein

Garth E. Pehrson has been named sales engineer for the Chicago district office by Graver Water Conditioning Co., division of Union Tank Car Co. Mr. Pehrson will handle Graver's complete line of equipment for industrial and municipal water treatment, industrial waste treatment and chemical processing. The Chicago Office is at 228 North La Salle Street.

Mr. Pehrson is a liquid treatment engineer with wide experience in the practical and theoretical aspects of equipment design, application and operation. Prior to his appointment he was a process engineer in Graver sales department for two years and before that a member of the service department for three years. He holds a BS degree from Brigham Young University in Utah and has done graduate work there and at Georgetown University, Washington, D. C.

J. D. Rodgers and **R. A. Nederman** have been named technical service representatives of Oakite Products, Inc., in Houston and Kansas City, respectively.

Mr. Rodgers, a graduate of Texas Tech, replaces Ed Lacy, who retired recently after 37 years with Oakite. Mr. Nederman, who was educated at the University of Minnesota, is a native of Kansas City. Both men completed an intensive eight-week training course in the field and the laboratories of Oakite.

Daniel Post has been appointed market research analyst for Solvay Process Division, Allied Chemical Corp.

Mr. Post is a chemical engineering graduate of Columbia University. He also holds a law degree from Smithdeal-Massey College of Law, Richmond, Va.

Joining Allied Chemical's Nitrogen Division in 1950, Mr. Post was assigned to chemical engineering work at the Division's Hopewell, Va. plant. Prior to his present appointment, he had been engaged in product development activities at Nitrogen's New York office.

Samuel Rothstein, formerly consulting engineer at the Fairchild Camera & Instrument Corp. in Long Island, New York, recently joined the technical staff of Greenwich Engineering Division of the American Machine & Foundry Co. as head of its metallurgical and materials group.

In this capacity, he will act as metallurgical consultant to the laboratory and shop personnel. He will be closely associated with R & D efforts and will serve as metallurgical specialist for the Greenwich Engineering Division in contacts with customers and government scientists and engineers. His activities will cover all phases of the division's projects, starting in the proposal stage and progressing through the concept, design and development, and final manufacture stage.

Mr. Rothstein has had extensive metallurgical experience in all types of materials applications including ferrous and nonferrous metals and plastics, metallurgical laboratory techniques, non-destructive testing, chemical analysis, and various phases of metallurgical production such as heat treating, plating and machining.

Mr. Rothstein received the BS degree at the College of the City of New York in 1940. He also attended the University of Illinois, New York University and Brooklyn Polytechnic Institute.

During World War II, Mr. Rothstein served as an instructor in aircraft materials and engines at the U.S. Air Force technical schools at Chanute Field, Rantoul, Illinois, and Keesler Field, Biloxi, Mississippi.

He is a member of the American Society for Metals, American Electroplaters' Society, American Society for Testing Materials, and the American Welding Society.

Mr. Rothstein, his wife, and their three children reside in New Hyde Park, Long Island.

Hugh V. McGuire has been appointed assistant to the sales manager of Enthone, Inc. subsidiary of American Smelting and Refining Co. He will specialize in the marketing of the metal finishing equipment and accessories manufactured and distributed by the equipment department.

Mr. McGuire is a graduate of Rutgers University. He has been employed by the Jack S. Steele Co. of Philadelphia as manager of their Matawan, N. J. branch office and by Hanson Van Winkle-Munning Co. of Matawan, N. J., as manager of general equipment sales. Most recently,

he headed up his own equipment engineering firm, McGuire Associates of New York City.

A member of the American Electroplaters' Society, Mr. McGuire presented a paper at the recent 45th Annual Convention in Cincinnati entitled "Design and Engineering Problems in Plating Room Layout and Installation".

Kenneth D. Miller has joined Enthone as design engineer in the equipment department. Mr. Miller is a mechanical engineer and was formerly head of the electrical department of Mead-Morrison Division of McKiernan Terry Corporation, Harrison, N. J. He comes to Enthone from Hanson-Van Winkle-Munning Co. where he was group engineer in the continuous equipment department.

Mr. Miller is a member of the National Association of Power Engineers.

K. D. Miller H. V. McGuire

H. K. Tsourmas T. Wolf

Harry K. Tsourmas and **Thomas Wolf** have joined Enthone, Inc. They will assist in the continued expansion of Enthone's research and development program.

Mr. Tsourmas received the BS degree in chemistry from Columbia University in 1949 and is presently doing graduate work in metallurgy at Stevens Institute of Technology, Hoboken, New Jersey. He has had nine years of experience as electroplating chemist and plating supervisor for several different firms. He comes to Enthone from Insulated Circuits, Inc., Passaic, New Jersey where he was in charge of specification plating and finishing of printed circuits.

Mr. Wolf graduated with honors from Trinity College, Cambridge, England, in 1956, receiving the degree in chemistry. He was employed as a research chemist in the resin research laboratories of Coates Brothers and Co. Limited, Kent, England and, after coming to this country, as a research group leader with Wymat Chemical Co. Harrison, New Jersey.

RUDOLPH A. LANGER

Rudolph A. Langer, president of American Metal Market Company, died Wednesday, Dec. 24, at South Nassau Communities Hospital, Oceanside, Long Island. He had undergone abdominal surgery on Nov. 7.

Mr. Langer was born in New York City in 1895. He joined the staff of *American Metal Market* in March 1909, as office boy. Over the years, he filled a number of positions and in 1931, became advertising manager. Elected secretary of the company in 1934, he subsequently became vice president, and ultimately president.

As a member of the 13th Regiment, New York National Guard during World War I, he participated in both the St. Mihiel and Meuse-Argonne offensives in France.

His wife died April 10, 1958. He is survived by a daughter, Mrs. Muriel L. Crook and three sons, Charles A. Thiele, Norman A. Langer and Donald R. Langer, eastern advertising representative of *American Metal Market*. Also surviving are a sister, Mrs. Rose Keith, three brothers, Walter and August Langer and Norbert J. Langer, associate editor of *American Metal Market*.

VERNE E. MINICH

Verne E. Minich, 91, founder of Wheelabrator Corp., Mishawaka, Indiana, and honorary chairman of the board, died Saturday, Dec. 13, in a New York City hospital following an illness of several months.

Early in 1908 Mr. Minich acquired exclusive sales rights from the Stockham Homogenous Sand Mixer Co., manufacturers of a mechanical sand conditioning machine for the foundry industry. Later in that year he took over this organization and started a new company, Sand Mixing Machine Co., to manufacture and sell these machines which he called the Sandcutter. In 1910 operations were moved to Cleveland, a line of anti-pressure sandblast cleaning machines added, and the company name was changed to American Foundry Equipment Co.

Consolidations with other foundry equipment manufacturing plants followed until finally in 1926 the headquarters and plant of the firm was established in Mishawaka. Later with the introduction of the Wheelabrator airless abrasive blast cleaning unit, the company name was changed to American Wheelabrator & Equipment Corp., and then in 1955 again changed to Wheelabrator Corp.

VAN WINKLE TODD

Van Winkle Todd, 66, chairman of the board of directors of Hanson-Van Winkle-Munning Co., Matawan, New Jersey, died suddenly Thursday, Jan. 15, at Monmouth Medical Center, Long Branch, N. J.

Mr. Todd was born in Newark, N. J., the son of the late Edmund N. and Anna Van Winkle Todd, and the grandson of the late Abraham Van Winkle, founder and president of The Hanson & Van Winkle Co. of Newark. Mr. Todd was president of this company at the time it merged in 1927 with A. P. Munning & Co. of Matawan. He was president of the Hanson-Van Winkle-Munning Company from 1927 to 1948 and chairman of its Board of Directors from 1948 until his death.

Mr. Todd was graduated from Lawrenceville School in 1911, and was a member of the Princeton University Class of 1915. He served in World War I as first lieutenant of the 103rd Aerial Squadron and saw service in France.

Mr. Todd married Frances Loraine Timpson of Orange, New Jersey in 1914. They lived in Short Hills, N. J. until moving to Matawan in 1928.

Surviving are his wife, Mrs. Frances Loraine Todd; four daughters, Mrs. Barbara Todd Townsend of McLean, Virginia; Mrs. Phyllis Todd Ellis of Gig Harbor, Washington; Mrs. Margaret Todd Boots of Lincroft, N. J.; and Mrs. Anne Todd Ashley of San Anselmo, California; ten grandchildren, and two brothers, Nelson Todd of Middletown, N. J.; and Edmund N. Todd of Miami, Florida.

Mr. Todd was a member of the Essex Club, Newark; Princeton and Whitehall Clubs, New York City; The Electrochemical Society, American Electroplaters' Society and the American Legion.

Mr. Todd was one of the very early members of the Newark Branch of the AES. He took part in the activities of the Newark Branch Bank Street Laboratories in 1915, and was an active member of the Branch for 45 years.

BRANCH NEWS

Total AES Branches U. S., Canada Australia, January 1, 1959 — 58.

BLUE RIDGE

Alloy Plating Presented by Gore; Samples of Plating Exhibited

Blue Ridge Branch held its regular monthly meeting on Dec. 5, 1958 at the Hut restaurant, Route 220, Martinsville, Virginia, **T. R. Boggess** presiding.

Several of the members brought examples of their plating and special techniques to exhibit at the meeting. These exhibits included a gold-silver-rhodium plated (on plastic) chess set, bronze plated baby shoes, brass on nickel tubular furniture legs, nickel, rhodium, and solder plated printed circuits, aluminum plating on steel and copper, and a silver plated, block tin cream pitcher.

The speaker of the evening was **Robert Gore** of Metal and Thermit Corp. He spoke of the subject of alloy plating. Alloys are plated to produce deposits of special and even new properties. Mr. Gore discussed some specific applications of alloys of tin, such as tin-lead; tin (65 per cent)—nickel (35 per cent); tin (25 per cent)—cadmium (75 per cent); tin (78 per cent)—zinc (22 per cent); and bronze plating.

N. F. Murphy
Acting Secretary

BRITISH COLUMBIA

Plating Course Discontinued; Ladies Night Planned

Thirty members and guests were present at the Nov. 19 meeting at the White Spot Dining Room in Vancouver.

Vice President **Gordon Smith** acted as chairman at this meeting in the absence of our President **Jim, Lee.**

It was moved by **Jim Hurford** and seconded by **Bill Marquardt** that three new members be elected. The motion was carried.

It was moved by **Nelson Shepherd,** seconded by **George Caslor** and carried that the next general meeting be held at the Horseshoe Restaurant.

Bill Marquardt generously offered to approach **John Brandelmayr,** a prominent naval architect, to speak on the subject of "Boats and Boating" at the next general meeting.

It was moved by **Walter Kellerman** that the next general meeting include the ladies. This was seconded by Bill Marquardt and carried. The next meeting on Dec. 17 will include the ladies and will be our Christmas meeting.

Mr. Kellerman reported that after many unsuccessful attempts to increase the attendance, it was necessary to discontinue the night school course for this year. It will be possible to have a course next year but he felt that it would be necessary to start preparations and publicity at a much earlier date than we have done in the past.

The chairman read a letter from national headquarters concerning the windshield decals commemorating the GOLDEN ANNIVERSARY YEAR. The decals were distributed to all the members at this time.

The program committee headed by **Jim Hurford** at this time had no definite plans for the new year.

After we had completed the business part of the meeting we all enjoyed viewing a sound color film entitled "Song of the Clouds" which had been generously provided by the Shell Oil Co. This film dealt with various aspects of commercial flying as well as an insight into the complexities of air traffic control as they exist today. The meeting came to a close at 11:00 p.m.

BRITISH COLUMBIA

Design and Construction of Boats Heard

Forty-three members and guests were at the Horseshoe Restaurant for the Dec. 15 meeting.

President **Jim Lee** opened the meeting with a welcome to our guests.

The secretary read a letter from John P. Nichols, national executive secretary, in reply to our letter of Dec. 2, 1958.

An item on the agenda was the Electroplating Night School Course. President Lee asked for some expression of thought by the general membership as to planning for next year's course at a very advanced date. It was suggested by **Walter Kellerman,** the instructor of the course, that discussion should be postponed to the next general meeting.

It was suggested by President Lee that the next general meeting be held on Wednesday, Jan. 14 at the Huntington Rubber Co. in Port Coquitlam.

Past President, **Bill Marquardt** introduced **John Brandlmayr,** our guest speaker. Bill told us that Mr. Brandlmayr was a graduate of the University of Saskatchewan in mechanical engineering and has earned himself a name as a designer of watercraft.

John Brandlmayr delivered an extremely interesting talk, illustrated by color transparencies of action shots, and explained some of the design features and construction of boats. He illustrated the difference between planing hulls and displacement hulls using small models as visual aids. Another factor on which he touched, was weight distribution and in conjunction with this the location of motors.

N. A. Shepherd
Secretary

BUFFALO

Annual Christmas Party; Regional Program Nearly Complete

The usual business and technical meeting of the Buffalo Branch was replaced in December with the Annual Christmas Party held Saturday evening, Dec. 20, at the Niagara Manor. Everyone had a good time thanks to the fine work of the committee headed by **Roger Brown** and ably assisted by **Robert Eich** and **Roy Laciura.**

The program for the 5th Empire State Regional Meeting to be held in Buffalo, April 11, 1959 at the Hotel Stuyvesant is near completion and will be announced in the March issue of PLATING.

Robert E. Lienert
Secretary

CENTRAL MICHIGAN

Hart Speaks on Nickel Plating

Central Michigan Branch met for its monthly dinner-meeting and educational session on Tuesday evening, Dec. 2, 1958 at the Roosevelt Hotel in Lansing.

Thirty-nine members were in attendance.

The speaker for the educational meeting, introduced by **Harry E. Anderson,** Branch librarian, was **John S. Hart** of the Hanson-Van Winkle-Munning Co. The subject of Mr. Hart's talk was "Some Recent Developments In Nickel Plating." The subject was ably presented and profusely illustrated through the use of slides. In addition to the presentation of data covering the newer types of nickel plating baths, results were discussed regarding several baths of the "laboratory curiosity" nature which, it was indicated, may hold future promise.

A short business meeting, was conducted by President **Ken Haworth.**

Homer E. Welch
Second Vice President and Publicity Chairman

CHICAGO

Geissman Talks on Project 18

The Chicago Branch held its December meeting at the Western Society of Engi-

BRANCH SECRETARIES

Branch News is required of all Secretaries monthly by AES Bylaws. First of the month is Branch News deadline for next PLATING issue. Any items on hand on that date will be carried in that edition. Later arrivals will appear in the issue immediately following. In reporting talks given by speakers before the Branch, please give titles of the talks, the speakers' full identification and any other pertinent information of interest to other Branches and PLATING's broad readership.

neers on Friday, Dec. 5. The January meeting will be a joint meeting with the Electrochemical Society. The meeting will be held at the Chicago Engineers' Club Jan. 9, 1959. **Dr. Henry Brown** of the Udylite Corporation will discuss "The Mechanism of Electrodeposits."

Following the business meeting, **Joseph C. Corre,** librarian, introduced the speaker of the evening **William Geissman,** superintendent of metal finishing at National Lock Co. Rockford, Illinois. Bill Geissman studied chemical engineering at Marquette University and is responsible for polishing, buffing and metal finishing at National Lock.

The subject was a report on AES Research Project 18—"The Mechanical Finishing of Metals." The project has been assigned to Chicago with **Clyde Kelly** as district supervisor; William Geissman, project director and **R. Scott Modjeska** as chairman of the project. The work on Project 18 has been started by Bill Geissman and the following factors have been found to affect the polishing and buffing of zinc-base die casting. (1) The peripheral speed of the buff (2) linear speed of the work (3) speed of buff oscillation (4) the amount of pressure applied (5) amount and kind of buffing compound applied (6) type of buff and (7) the character of the metal.

The technical information from the result of this study on the polishing and buffing of zinc base die-casting will be of tremendous interest to the polishing and buffing trade. A goodly number of questions followed which showed the keen interest of the audience in his talk.

Christopher Marzano
Publicity Chairman

CINCINNATI

Bingo Feature at Ladies Night

On Dec. 9, seventy-four persons turned out to take part in the Annual Ladies Night held at the Engineering Society. After a delicious turkey dinner, President **Helmich** spoke a few words of welcome to the group and then presented the Past Presidents' Pin to **Wilson Loveless.**

Gerry Poll then took charge of the affair and presented the speaker of the evening, Judge Benjamin Schwartz of the Juvenile Court. The Judge spoke on the subject, "The Ten Commandments for Parents." It was agreed by all that the text of the message was very timely and enlightening.

The festivities then switched to a bingo game during which eight lucky people took home some very fine gifts. The evening was completed with a Social Hour sponsored by the Wyandotte Chemical Co., **Charley Dumont** as host.

David L. Kaplan
Secretary

CLEVELAND

Crehan Discusses Electroless Nickel

The regular meeting of the Cleveland Branch took place on Dec. 5, 1958 at the Cleveland Technical Society Building. The guest speaker of the evening was **W. J. Crehan.** Mr. Crehan is manager of the Kanigen Division of the General American Transportation Company.

The various fields in which electroless nickel is being used were discussed by the speaker, and the advantages which this method of plating has over the conventional methods were also discussed. A very active discussion period followed the talk. The discussion brought out further details of the process and other special advantages offered by this type of coating.

The business meeting opened with the reading of the minutes from the previous month. Two members were accepted into the Cleveland Branch.

A get well card will be sent to **Bill Scott,** a charter member of the Cleveland Branch. Bill has been confined to his home due to illness. **Ralph Everstine** was injured in a plant accident and will also receive a get well card from the Cleveland Branch. Plans for the January dinner-dance are proceeding according to schedule and a good time is anticipated.

George A. Shepard
Assistant Librarian

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COLUMBUS

Beach of Battelle Presents Paper

The regular monthly meeting of the Columbus Branch AES was held at Presutti's Villa on Thursday, Nov. 6, 1958 at 6:00 p.m.

The business meeting was called to order by President **Harry Moore.**

The possibility of visiting the atomic reactor at Battelle Memorial Institute was discussed.

Librarian **Les McGraw** introduced the speaker of the evening, **John Beach** of Battelle Memorial Institute, whose subject was "Plating on Unusual Metals."

Following a question and answer session, and a round of applause for the speaker, the meeting was adjourned.

Halvor Christianson

COLUMBUS

Precious Metal Plating Topic of Weisberg

The regular monthly meeting of the Columbus Branch AES was held at Reebs Restaurant on Friday, Dec. 5, 1958 at 6:00 p.m.

The business meeting was called to order by Vice President **Marvin Pingel.**

The minutes of the October and November meetings were read and approved.

A new member was approved and elected.

Rudy Skriletz gave a report on the Tri-State meeting he attended Nov. 8 at Louisville, Kentucky. He is awaiting a report on a bylaw revision about finances and will present it to the Branch for comment at a later date.

Librarian **Les McGraw** introduced the speaker of the evening, **Alfred M. Weisberg** of Technic, Inc. whose subject was "Electroplating of Precious Metals." Mr. Weisberg gave a very interesting talk on precious metal plating.

Following a question and answer session, and a round of applause for the speaker, the meeting was adjourned.

Halvor Christianson

GRAND RAPIDS

Safranek Addresses Joint Meeting With Die Casting Engineers

Dec. 12 marked the second annual joint meeting of the Grand Rapids Branch with the Western Michigan Chapter of the Society of Die Casting Engineers. Despite bad weather, 79 members of both Societies met and enjoyed cocktails, roast sirloin of beef dinner, and interesting conversation about the many common problems of both die casting and electroplating.

Two new members were elected to the Society at the December meeting.

Librarian **Orville Hoxie** was complimented on the arrangement of the program which was of pertinent interest to members of both Societies. The main speaker for the evening was **William H. Safranek,** assistant chief of the Electrochemical Engineering Division at Battelle Memorial Institute whose subject was "Improved Electroplated Finishes for Zinc Based Die Castings." Mr. Safranek first outlined the purpose of the research program being conducted at Battelle for the improvement of electroplated finishes and for increased corrosion protection.

Mr. Safranek referred to the excellent correlation of the Corrodkote test and Acetic Salt Spray with outdoor exposure, particularly those at Kure Beach, North Carolina. Some excellent photographs were shown of variations in plating procedures and subsequent accelerated corrosion tests. Plating variations included increased thicknesses of copper and nickel plate, interposing leveling zinc plate between base metal and copper plate, and replacing conventional chromium with chromium of greater thickness under conditions favoring crack-free deposition. The added protection obtained by a deposit of 0.00008 in. of crack-free chromium was very apparent.

Mr. Safranek spoke briefly of the preliminary work done with duplex nickel plating, stating that protection is afforded in this case by the considerably less active semi-bright nickel layer. Panels plated with 0.0005 in. of semi-bright and 0.0003 in. bright nickel gave satisfactory performance after 2 cycles Corrodkote or 192 hours of copper acetic acid salt spray. Mr. Safranek stated that the duplex nickel can be plated under more satisfactory operating conditions than crack-free chromium because of the high current densities involved in the chromium process and the necessity of special equipment. Additional work is being done to find simpler methods of depositing chromium free of cracks and pores.

Mr. Safranek's talk was followed by an enthusiastic question period. Some interesting comments and opinions resulted. **Maurice R. Caldwell,** a member of the

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American Zinc Institute Research Committee on electroplated finishes, stated that too many people have been referring to the Corrodkote tests and copper acetic acid salt spray as a development of their own when the fact is that these tests were developed by the AES Research Project 15. He stated that it is the development of these tests which makes possible rapid and extensive corrosion evaluation in connection with other research with the assurance of very close outdoor exposure correlation. Once again we have an excellent example of the great value of our research dollar within the Society. Mr. Caldwell also commented that it was his opinion that crack-free chromium gave excellent apparent results on test panels, but these results could not be obtained by production methods on complex die cast shapes as readily as the duplex nickel process. He also stated that he felt the duplex nickel afforded better protection over surface porosity frequently found in zinc die castings.

Thomas C. Henner
Second Vice President

INDIANAPOLIS
Tri-State to Meet in April in Louisville

Inclement weather kept the attendance of the Dec. 1 meeting of the Indianapolis Branch to 22 members and guests. After the introduction of members, **Paul Johnson,** Branch librarian, introduced the speaker, **P. E. MacAllister** of the MacAllister Machinery Co., who spoke on the highway system of Indiana. He discussed the means of financing road building and the progress that is being made in building new roads and expressways in Indiana. The color film on the building of new through-ways, "We'll Take the High Road," was shown.

John Hood, Branch president, then opened the business meeting. A new member was accepted by acclamation. A report was made by **Les Reynolds** on the recent Tri-State Region Committee meeting which was held in Louisville. He stated that, in his opinion, Act VI, Paragraph I of the bylaws of the Tri-State needed revision. He felt that the reserve as set up presently is too low. This was referred to the Board of Managers for a recommendation on the motion of Les Reynolds and seconded by **Bob Bruck.** As the scheduled April meeting of the Branch also falls two days after the Tri-State meeting at Louisville, the possibility of changing this particular meeting night was referred to the Board of Managers.

A. M. Howard

LANCASTER
Streavig Describes New Plating Solution

The regular meeting of the Lancaster Branch took place Dec. 12, 1958 at the Overbrook Country Club Lancaster, Pa.

During our business meeting two new members were approved.

Our educational program consisted of a very fine talk from one of our members, **Wayne Streavig.**

Wayne talked on a bright brass plating solution which he developed.

I. Paul Sharretts
Secretary-Treasurer

LOS ANGELES
Panel on Copper Plating

The meeting was opened by President **Norm McEwan. Bill Heinecke** was called upon to introduce the guests.

In the absence of **George Hetz, Frank Virgil** introduced two men who have petitioned for membership in the Society.

It was reported that **Harold Kroesche** was seriously ill in the hospital. Flowers were sent from the Society. It was reported by **Dave Althouse** that **John VanBergen** was ill.

There was a panel discussion on Copper Plating. The panel members were **Milt Weiner,** consultant; **Glen Beckwith,** of American Buff; **Ozzie Grissat,** Ajax Hardware; and **Don Baudrand,** of Electrochemical Laboratories.

Don Baudrand
Secretary

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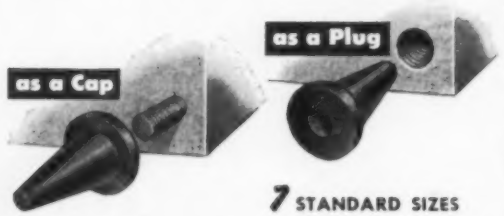

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LOS ANGELES

Bellinger Discusses Chromating

The meeting was called to order at 8:25 by President **Norm McEwan.** **Bill Heincke** introduced several visitors.

George Hetz introduced a prospective member.

Two new members were initiated into the Branch by President McEwan.

Don Bedwell announced the death of **Harold Kroesche.** Harold was a prominent member of the Los Angeles Branch. Don Bedwell moved that a collection be taken to be donated to the American Cancer Society, as Mr. Kroesche died of cancer. The motion was carried. A collection was made, and a sum normally paid by the Society for flowers was to be added to the $75.55 collected.

It was announced that the price of the dinner at the Rodger Young auditorium is to be raised to $3.75 beginning next meeting.

Harvey Hunt introduced **Ken Bellinger** who told us about "Recent Developments in Chromating." He told of the advantages and limitations of chromate coating. He described dyes used in Color chromating. There were a large number of questions from the floor.

Don Baudrand
Secretary

LOUISVILLE

Seven New Members; Smith Speaks on Barrel Chromium Plating

The regular meeting of the Louisville Branch was held on Nov. 20, 1958 at Hasenour's Restaurant with 22 members and three guests present. Our membership drive for the year was substantially rewarded with the acceptance of six new members and one transfer into the organization.

Art Oertel, chairman of the Membership Committee, gave a short resume of his plan to have an "Industry Nite" at each meeting where the company member selected would endeavor to bring a few guests and have someone give a short talk on plating operations at his plant.

Ken Reifsteck, finishing planning supervisor at General Electric's home laundry department, who was selected as the first speaker, presented an interesting picture of the plating and finishing sections of the large washer and dryer facility at Appliance Park, Ky.

The progress of our plans to hold the Annual Tri-State Regional Meeting in Louisville next April was also discussed by Mr. Reifsteck.

After the business session, our librarian introduced **Philip J. Smith** of the Metal and Thermit Corp. who talked on the development and present use of Barrel Chromium Plating. Mr. Smith traced the history of the barrel from the first German invention in 1927, through the 16 or so various patents, to the state of the art as it exists today. He emphasized the important points of good contact, the necessity of having a single layer of parts in contact with the cathode cylinder, the importance of a solution to take a make-and-break in contact and the continuous movement of the parts.

The meeting was adjourned after a short question and answer session.

Louis W. Dawson
Recording Secretary

NEWARK

Wagner Discussed Lead Plating, Walczyk Presents Printed Circuits

The December meeting was held on the 12th with 55 present. One membership application was received and four new members were elected.

Fred Meyer, Christmas Party Chairman, reported all set for Saturday night and urged a good turn-out. **George Reuter** stated that the Branch history was in the final stages as the result of a meeting that evening attended by **Sam Taylor, Ed Faint** and **Don Foulke.**

Librarian **Al Korbelak** then introduced **Eugene Wagner** who discussed "Lead Plating." He pointed out the purposes for lead deposits, the solution composition, conditions and explained how the bath must be maintained. Lead-indium and

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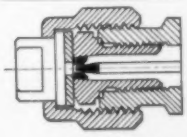

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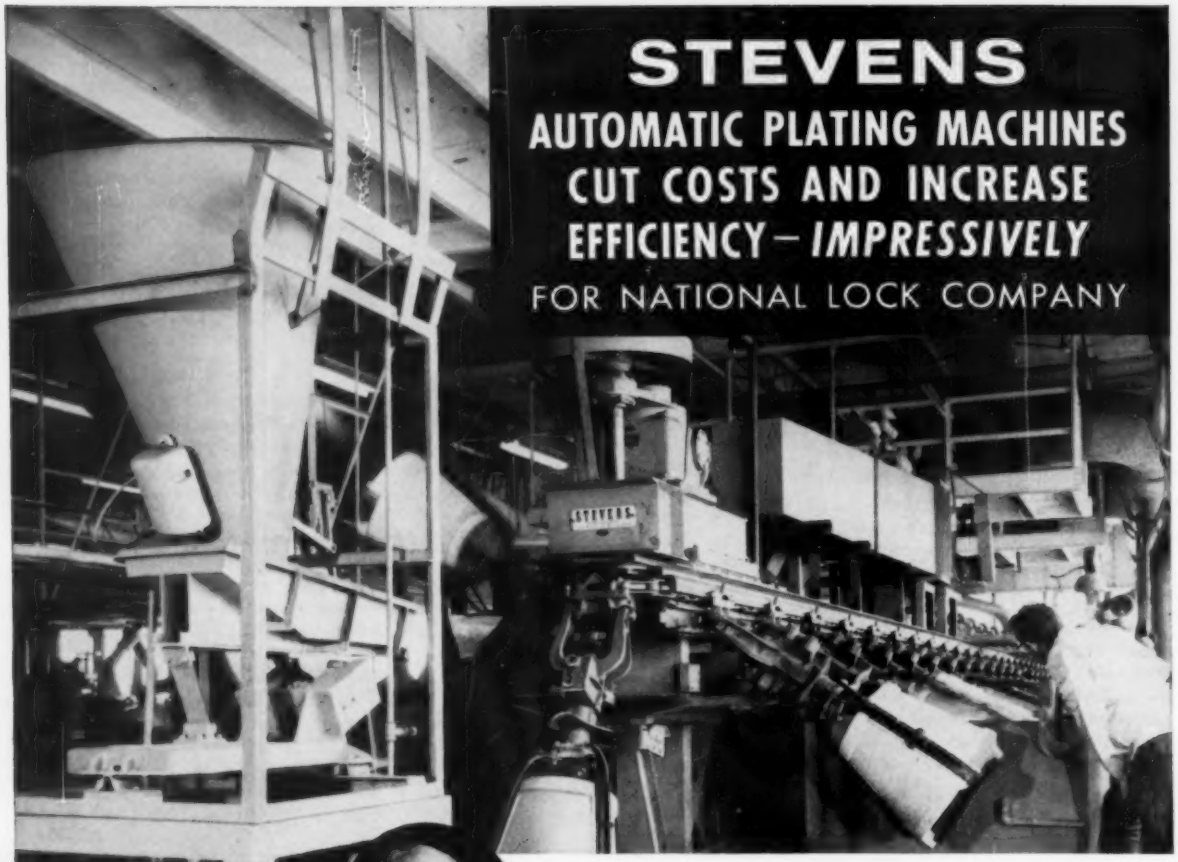

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silver-lead bearings were described and stripping methods given.

W. H. Walczyk of Remington Rand Division of Sperry Rand Corp. then presented a paper on "Printed Circuits." He noted that ½ million components per cubic foot of space could be achieved through the use of printed circuits and miniaturization. He discussed design for printed circuits and the various methods of preparing circuits and pointed out the trend towards plating through the holes. The increased use of electroless nickel and copper was noted as was the improved cleaners now available. It is now preferable to plate on both sides to reduce warpage, and gold is often used for corrosion resistance and good contact. Reliability is a first consideration. Many questions were asked attesting to the interest in the subject and it was agreed the program was a good one.

D. Gardner Foulke
Secretary

NEW YORK
Schore Talks on Rectifiers; Annual Meeting Plans

Our president, **Dr. Ed Saubestre,** called the Nov. 28 meeting to order at 8:30 p.m. The Recording Secretary, Mr. Anthony Briganti, and Messrs. Albert Fusco and Ralph Ligouri, of the Board of Managers, were noted absent.

An announcement was made that one page in the New York Branch's 50th (Golden) Anniversary banquet journal is being set aside as a "Booster" page. This will furnish members the opportunity to share personally in this year's history of the Branch by means of their signature in gold. Many members have already signed up and all other members are invited to do so.

AES GOLDEN ANNIVERSARY decals are available to members without charge. They make a very attractive ornament on a car or door window.

Joe Rembecki, banquet chairman, announced that there would be a Bingo Party for the ladies on Feb. 7, preceding the annual banquet, at which four $25 Government bonds would be awarded as prizes. Other banquet arrangements are proceeding satisfactorily. He hopes everyone will enjoy the steak dinner and imported wine.

Phil Bruno, our advertising chairman, reported that the suppliers have been very cooperative and he hopes to establish a new high in journal ads.

Librarian **Arthur Carlson,** next introduced **George Schore,** sales manager of Brucar Plating Equipment Supply Corp., who spoke on "Practical Applications of Rectifiers in the Plating Room." His talk, which will shortly appear in print, described the rating and characteristics of rectifiers necessary for specific plating baths. An interesting point was that ripple in the rectifier is not an important consideration if the metal normally can be plated using periodic reverse current. A question period concluded this meeting, which was well attended by competing suppliers among others.

Martin H. Pollack
Acting Recording-Secretary

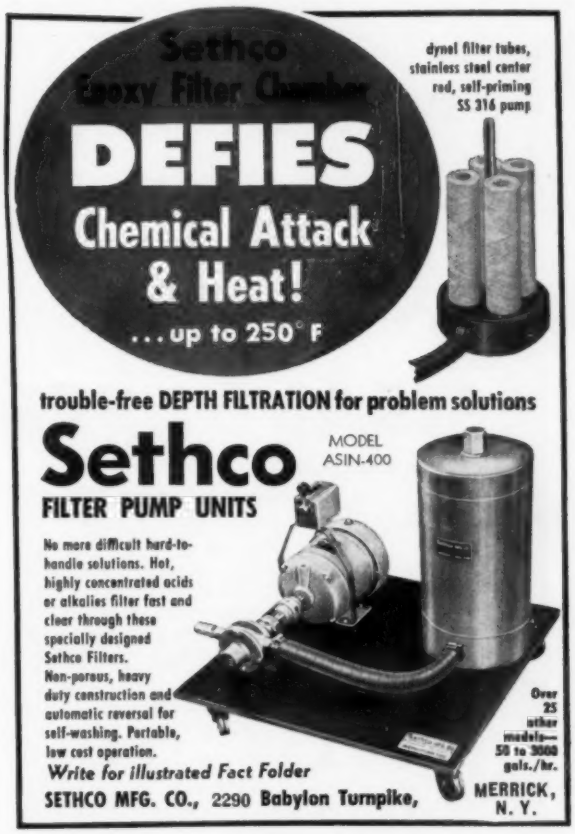
NEW YORK
Question and Answer Session

First Vice President **Joseph Rembecki** called the Dec. 12 meeting to order at 8:30 p.m. in the absence of **Dr. Ed Saubestre.** One new member was elected and welcomed.

Mr. Rembecki, as Banquet chairman, reported that the affair to be held on Feb. 7, 1959, will be a milestone in the fifty-year history of the New York Branch. Preceding the banquet there will be a gala cocktail party in the Statler's Penntop North, which will be sponsored jointly by the suppliers. The dinner will feature steak and imported wines. Tickets are priced at $12.50 per person.

This latter announcement prompted **J. A. Stremel** to reminisce about how he and Mr. Hogaboom ran the first N. Y. Branch Banquet at $1.00 per ticket—and made a profit on the affair.

Librarian **Arthur Carlson** introduced the panel of experts, **Messrs. I. Fried-**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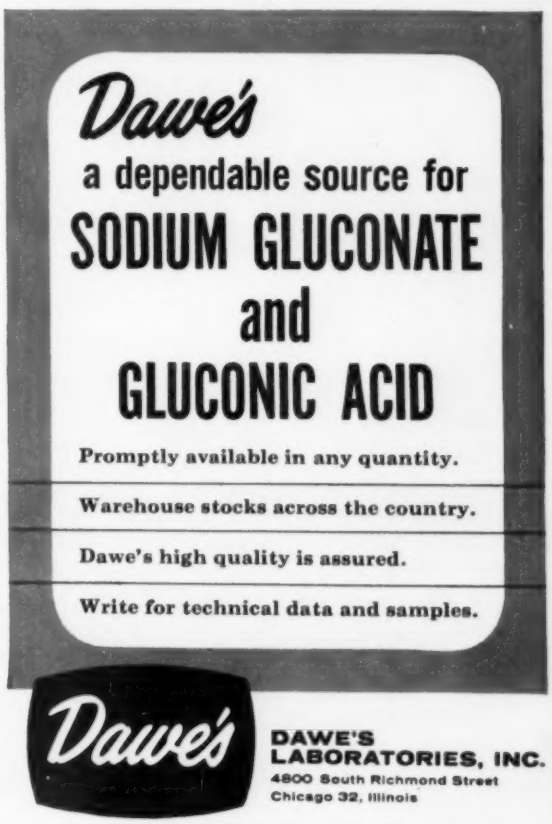

man, A. Fusco and **C. Weiner,** who presided over a rough-and-tumble Question and Answer Session. Needless to say, it seemed that the experts had most of the problems, which the members tried to answer as best they could.

To top off the evening, the Branch provided a sumptuous feast of fried shrimp, hors d'oevres, cheese and crackers, coffee and Danish pastry, and beer. It was a most successful meeting to close the year's activities.

Martin Pollack
Acting Recording Secretary

PHILADELPHIA

Panel Discussion on Four Subjects; Seeking 1960 Interim Meeting

The meeting held on Dec. 15 at the Engineers Club was attended by 55 members and guests, including a portion of **Dr. Samuel Heiman's** class in electroplating from Temple University. After hearing minutes of previous meetings, the treasurer's report and receiving a new application, the names of 30 members suspended for non-payment of dues were read by the secretary. Membership Chairman **Cogan** asked for the aid of all who know those suspended to try to get them reinstated.

Branch President **Farren** asked for discussion on plans for the Branch's Jubilee celebration in 1960, the 50th anniversary of the founding of the Branch. A motion was made by Mr. **Trusdell** and carried that the Philadelphia Branch 50th Jubilee Celebration be held in conjunction with the 1960 AES Interim Meeting, this being contingent on Philadelphia being the site of the 1960 Interim Meeting; that the Jubilee Celebration would replace the 1959 Annual Educational Session and Banquet; that the Philadelphia Delegates be instructed to act accordingly at the National Meetings.

Mr. Trusdell made a motion and carried that the Philadelphia Branch Delegates be instructed to go to the Detroit Convention and work to obtain the 1965 AES Convention.

The educational portion of the meeting was devoted to a panel discussion featuring a panel of four Philadelphia Branch members, with Librarian **Hauseman** as moderator. Each panelist introduced his subject with a ten minute talk, followed by a question period after all the panelists had spoken. The members of the panel were: **Joseph W. Berenato Jr.,** J. Berenato—"Brass Plating"; **Nat Verrelle,** Philadelphia Manufacturing Co.—"Oxidized Finishes"; **Paul Mentzer Sr.,** Mitchell Speciality Div., Industrial Enterprises, Inc.—"Polishing"; **Joseph H. DeVoren,** Silversmith—"Refinishing Silverware."

Each of these men work at plating and spoke about the practical aspects of their work. The subject matter presented and the very animated discussion following their talks again showed this type meeting to be one of the most popular and interesting in the scheduled meetings of the season.

I. Wm. Marcovitch
Secretary

PITTSBURGH

Proposed Waste Regulations Heard

The last meeting of 1958 was held at the Gateway Plaza, downtown Pittsburgh. Dinner, 6:30 p.m. Meeting, 8:00 p.m.

In addition to regular members, there were twelve guests.

Librarian **C. A. Forbes** was fortunate in securing as main speaker, **John F. Laboon** of the Allegheny County Sanitary Authority. The topic: "Proposed Regulation of Industrial Wastes by the Sanitary Authority." Mr. Laboon's topic was of exceptional interest to all and very well represented.

Ed. Keller
Secretary

ST. JOSEPH VALLEY

Modjeska Discusses Stainless Steel Finishing; Joining Midwest Regional

The November business meeting was called to order at 6:30 p.m. by President **Ray Dearth.** One application for membership was read and will be voted on at the December meeting.

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President Dearth appointed **Gene Roth,** chairman of the Bylaws Committee, with **Lou Rague** and **Dick Aiker** as assistants. The new bylaws are to be read at the December meeting, voted on in January, and sent to the membership in final form in February.

National First Vice President **"Duke" Wysong** spoke briefly on the GOLDEN ANNIVERSARY Convention and Exposition to be held in Detroit and its anticipated large attendance. He urged the membership to make every effort to attend.

A motion was made and seconded for the St. Joseph Valley Branch to become an active member of the Midwest Regional Association.

After a brief question and answer period, the meeting was turned over to Librarian **Jack Petersen** who introduced the speaker of the evening, **Scott Modjeska** whose subject was "The Finishing of Stainless Steel."

His discussion included the types of stainless steel, mechanical finishing, chemical finishing, coloring, electrochemical treatments and plating and passivation. In mechanical finishing, iron free abrasive must be specified in order to obviate a possible dangerous structural change in the base stainless.

Alkali cleaners must be low in free alkali to avoid attack of the chromium. The cleaners are used at as low a temperature and current density as possible, particularly in the 400 series. The removal of scale is a two stage system: (1) loosening of scale in 12 per cent H_2SO_4 at 140 F or in 15 per cent HCl at 140°, (2) removal of scale in HNO_3-HF. Scale may also be removed with proprietary alkaline products.

Passivation of stainless may be accomplished in 20 per cent HNO_3 at 120F followed by a dip in hot $Na_2Cr_2O_7$ solution. Electropolishing is a very expensive form of passivation. Adequate contact is of the utmost importance. Various compositions of H_2SO_4 and H_3PO_4 with additions of glycolic acid and water constitute good baths. Glycerin and citrates are added in some cases to avoid poor results on extremely high current density areas.

Stainless steel is plated to match other plated components for wear applications, conductivity, solderability and to offset galvanic couples. Activation of the surface is accomplished in a number of ways, both in HCl and in H_2SO_4 using cathodic current or a combination of anodic and cathodic current. All processes require a minimum transfer time between activation and plating, therefore a Woods nickel strike is often used to deposit nickel simultaneously with activation.

Because stainless is a poor conductor, more positive contacts are essential.

Mr. Modjeska was accorded a standing round of applause for an interesting and well delivered paper. **Paul Glab,** secretary of the Chicago Branch, who was a welcome guest, spoke briefly of the Chicago annual symposium on Bright Nickel and invited attendance.

H. A. Meers
Secretary

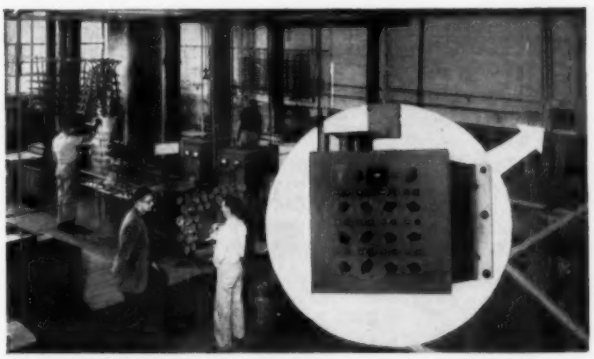
ST. LOUIS

Tour National Rejectors Plant

Our president, **William George,** who is employed by National Rejectors Co. and Librarian **Arthur Wrisberg** arranged for our Branch to tour the National Rejectors plant. A group of about 50 members and guests gathered at the plant about 7:30 and were taken with a guide through the plant. The group was able to observe the entire plant which includes full automatic cadmium and nickel chrome plating equipment, barrel plating, tumble deburring, and also an automatic conveyorized washing, phosphatizing and painting installation.

In addition to this we were fortunate to have a complete display of the coin machines they manufacture. The slug rejectors, both electric and mechanical; Flex-O-Mec, accumulator and dollar bill changing machine attracted much attention.

After the tour a buffet lunch was



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served, courtesy of National Rejectors. We want to thank **Raymond Gottfried** and **William Gatley** of the company for their cooperation in making this plant visitation possible.

Ward Kelly
Secretary

TORONTO

Dr. Brown Presents Paper on Corrosion Studies

The December meeting of the Toronto Branch was held in the Royal York Hotel, 28 met for dinner. The lovely decorated tree reminded us of the fast approaching visit from Good Saint Nick and so ends another year.

Bob Edwards presided, 50 members gathered to hear **Dr. Henry Brown** of Udylite Research Corp., who was introduced by **Doug Hanna** of Canadian Hanson & Van Winkle Co. Dr. Brown's subject "Corrosion Studies with Various Combinations of Nickel and Chrome Plate" his talk accompanied with slides was well presented in the layman's language and proved very interesting. Dr. Brown is to be congratulated, the question period was very informative and the Doctor was thanked by **Mel Green** of Armalite Co., Toronto.

A. W. Wilson
Librarian

WATERBURY

New Sustaining Member; Precious Metal Plating Presented by Sloan

The December meeting of the Waterbury Branch was held at the Roger Smith-Elton Hotel on Thursday, Dec. 11. It was announced that the Branch had added its twentieth sustaining member with the signing up of Wallace Silversmiths Inc. **Ray Mitchell** has done an outstanding job in securing additional sustaining members.

Announcement was made that the Branch Social Evening would be held on Valentine's Day, Feb. 14 at the Chase Country Club. This is a departure from our usual Christmas Party in order to take some of the strain off the Christmas social calender.

Nick Topazio of the Patent Button Co. introduced our speaker of the evening, **Perry Sloane.** Mr. Sloane whose subject was "Precious Metal Plating" has had many years experience in this field, most recently with Harper-Leader, Inc. He gave an excellent paper on the subject and dealt with many aspects of precious metal plating related to the aircraft, missile and electronic industries. He had some choice remarks about plating specifications particularly from the platers point of view.

The meeting was adjourned and the next meeting will be Sustaining Members Night in January.

F. A. Schneiders
Publicity

PREVIEW OF FUTURE PLATING MAGAZINE ISSUES

MARCH 1959
ORGANIC COATING. The importance of organic finishing to electroplaters is increasing rapidly. New and review material will be presented in this third annual edition.

•

APRIL 1959
RESEARCH ISSUE. A feature will be its documentary section embracing the AES's Research Program in American and Canadian universities and foundations, including an historical summary by Dr. William Blum plus a status report on current research projects by AES's current Vice Chairman for Research. Also other technical and scientific papers plus Golden Jubilee news and developments.

•

MAY 1959
PRE-GOLDEN JUBILEE CONVENTION. A larger than usual issue featuring both technical and scientific papers, together with important coverage of Golden Jubilee Convention, Exposition and International Conference news and data of broad readership importance.

•

JUNE 1959
GOLDEN JUBILEE. A unique feature issue climaxing the Fiftieth Anniversary observance of the American Electroplaters' Society, PLATING's parent, it will be targeted both for immediate interest to PLATING's global circulation and for long retainment as an AES reference source and as a memento of this year-long observance.

•

JULY 1959
POST-CONVENTION. An abundant issue carrying not only scientific, technical and practical plating papers and other educational data of substantial readership interest but also much exclusive post-GOLDEN JUBILEE Convention news and features.

•

AUGUST 1959
Another annual edition of PLATING's widely anticipated WATER AND WASTE TREATMENT issue.

•

NOVEMBER 1959
Third annual edition of PLATING MAGAZINE's popular AIRCRAFT ISSUE, this edition, judging by its blueprint at this stage, looms as one of PLATING's strongest future editions, a worthy follower of expectedly effective SEPTEMBER and OCTOBER 1959 general issues.

WESTERN ONTARIO
Visit New Plating Plant

The Western Ontario Branch met at the Mirwin Hotel, in Wallaceburg Ontario, as guests of **H. V. Peterson** and **Nick Godo,** president and vice president of Luster Chrome, a brand new plating industry in Wallaceburg.

As our guest we had the Kent Chapter of the Professional Engineers of Ontario, and **Mel Green,** president of Armalite, Toronto.

A minute of silence was proposed by President **Dave Mainland** in memory of **Glen Watson,** president of the Branch in 1952.

After our business meeting **Norm Southern** introduced **Harry Marks** of Fisher Scientific, Industrial Products Division, as guest speaker. He in turn had a guest, **Harvey Travers,** senior engineer of Corning Glass in New York. His subject was the "Magic of Glass."

We were told about E. C. (electrical conducting) glass. Photosensitive glass was also described and we were shown Pyro-Ceram. A self sealing glass, "Dream Glass," was demonstrated. A fine movie showed the history of glass and the art of fabricating it into various useful articles.

Luster Chrome was mentioned as the first in the plating industry to use Corning glass valves.

Don Berry thanked the speaker for a fine and informative evening. Later the Branch visited the Luster Chrome plant. Messrs. Peterson and Godo are to be complimented on a fine shop.

Leo Horodyski
Vice President

AES MEMBERSHIP REPORT

ELECTIONS

Adelaide: R. L. Barton, P. J. Cavanagh
British Columbia: B. Lyhne, I. S. Peacock, T. Wallington
Chicago: E. Bottje, H. H. Halaska, S. W. Putek, B. Rudenga
Cleveland: F. E. Haas, E. E. Van Tassel
Columbus: M. M. Morelock
Dayton: E. F. Oblinger
Detroit: D. I. Johnson, R. A. Maser, R. K. Miller, W. Tawyea, J. Toth, E. E. Treend
Grand Rapids: D. O. Hubbard, W. J. Jacobs
Kansas City: R. H. Bell, F. E. Swann
Lancaster: P. Johns, J. Samos
Montreal: C. Butterman, E. Plamondon
Newark: G. Bartley, H. Brown, J. Conolly, W. H. Miller
New York: A. Nosty
Portland: P. H. Keller, R. H. Morseth, K. G. Tyler, K. N. Tyler
Seattle-Puget: W. O. Ross
Southeastern: H. J. Cain, R. B. Cassidy, P. F. Gentry, J. T. Hall Jr.
Toledo: M. Ely
Toronto: E. C. Pitman, N. Weatherston
Member-at-Large: F. W. Anderson, Buxton, England

REINSTATEMENTS

Cleveland: W. S. Springer
Dayton: R. C. Wolfe
Detroit: C. B. Murphy, Dr. J. Stareck, C. F. Tower
Grand Rapids: M. Tardiff
Los Angeles: J. Wissman
New York: C. G. Dinallo
Pittsburgh: H. L. Franks

TRANSFERS

Buffalo: G. Bartle from Los Angeles
Chicago: J. B. Wheeler from Dayton
Cleveland: L. Hanlon to Detroit
Columbus: C. B. Murphy from Detroit, R. C. Brown to Indianapolis
Detroit: L. Hanlon from Cleveland, P. Harper to Los Angeles, O. Klingenmaier from Grand Rapids, C. B. Murphy to Columbus, R. J. Radomski to Philadelphia
Grand Rapids: O. Klingenmaier to Detroit, M. Tardiff to Newark
Newark: W. W. Brodin to Detroit, F. Dayton to Dayton, C. Rust to Baltimore-Washington, M. Tardiff from Grand Rapids
New York: B. Gallo to Bridgeport
Saginaw Valley: E. J. Cox to Detroit
Member-at-Large: E. L. Gostin to Newark

RESIGNATIONS

British Columbia: H. E. Sheppard
Buffalo: J. S. LaBude, J. R. Newcomer
Chicago: R. Meyers
Cincinnati: D. Shrout
Columbus: R. C. Althoff, D. Gordon, T. F. Jackson, P. F. Martin
Dayton: N. E. Wurster
Lancaster: H. E. Britcher, J. Mace, G. Wells
New York: L. R. Lawrence
Philadelphia: J. L. Nelson
Toronto: D. Black, W. T. Robinson

SUSPENSIONS

British Columbia: G. E. Patterson
Buffalo: H. Critzer, W. C. Rosedahl, J. A. Ross, T. Swanson
Chicago: W. L. Overstreet, H. E. Rogers
Grand Rapids: R. Baker
Los Angeles: R. C. Axsom, D. Barber, E. T. Bates, J. A. Beasley, R. E. Becker, O. M. Brown, A. E. Clenard, L. Daniels, W. P. Dugan, E. G. Elgin, W. B. Ellis, H. Ey, B. C. Gardes, E. E. Hamor, D. C. Johnson, P. O. Kerrigan, F. H. Kletka, L. L. Low, R. Maggiora, G. Mallory Jr., S. Martin, E. M. Mills, R. A. Mintz, W. A. Moeur Jr., M. Noblett, G. H. Otters, M. Perkins, J. J. Phelan, A. A. Polucha, E. G. Richardson, E. Riggs, D. Schein, W. A. Schuler, B. J. Sherwood, G. T. Sink, H. E. Smith, F. Stabile, N. S. Starke, D. D. Steele, J. H. Stewart, V. M. Stutzman, F. Taylor, J. A. Venier
Philadelphia: L. W. Abraham, C. S. Aloneftis, S. W. Bartha, J. M. Brady, W. H. Brown, E. W. Centanni, W. P. Conine, A. G. Conover, W. G. Hyndshaw, W. J. Jondreau, J. R. Jones, P. Karpiak, F. J. Krzos, F. C. Lawlor, P. J. LoPresti, N. D. Love, N. J. Maile, T. R. Metz, R. R. Moore, A. A. Noreika, J. E. O'Brien, G. H. Rhodes, P. J. Riley, J. E. Rothchild, L. Scarpati, J. M. Stone, A. D. Tentilucci, C. J. Wilmor, P. Zukowski
Saginaw Valley: A. C. Childers, J. Dvorsky, C. Ewing, A. E. Franklin, G. Germain, D. Rewbotham, J. L. Whitley
Seattle-Puget Sound: D. G. Carlton, A. C. Doll, H. A. Richards, A. Smolarick, T. E. Wadsley, A. Walker, H. F. Woodworth, A. J. Wright Jr.
Toledo: W. A. Cottingham, A. Szymanowski Jr.
Western Ontario: D. Thompson

DEATHS

Columbus: J. E. Brown
Los Angeles: H. Kroesche
Western Ontario: G. Watson

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SYDNEY

Secretary: M. R. Mackinnon
3 Hyde Brae St., Starthfield
New South Wales, Australia

Meeting Place: Committee Room, Sydney Technical College

Day of Month: Second Wednesday
Time: 7:30 P. M.

CLASSIFIED ADVERTISEMENTS

Only "Help Wanted" and "Situations Wanted" will be accepted. Rates: $.20 per word, minimum $5.00. AES Branch Members and Members-at-Large only, in good standing, are entitled (for personal use only) to a total of three free advertisements in any twelve-month period as of first insertion. Last day for inserting advertisements is the 10th of month preceding date of publication. When answering advertisements please address as follows: Box number, PLATING, 445 Broad Street, Newark 2, N. J.

SITUATIONS WANTED

METAL FINISHING ENGINEER—Age 31, BS Chemical Engineering. 9 years research, technical service, process engineering, product development, chromium chemicals for corrosion control, waste and water treatment, anodizing, chromium plating, metal surface treatments. Will relocate, preferably in the New England or Middle Atlantic area. Reply to Box F1, PLATING, 445 Broad St., Newark 2, N. J.

SWEDISH CHEMICAL ENGINEER—Age 32, married, with 5 years experience in all phases of decorative plating, including production, supervision solution control, troubleshooting and research, as well as anodizing and coloring of aluminum, desires position in the U. S. Joseph B. Kushner diploma. Reply to Box F2, PLATING, 445 Broad St., Newark 2, N. J.

SALES ENGINEER—Specialized education in chemistry and engineering, fifteen years service in quality control and development, six years experience in creative selling qualify me to represent quality line metal finishing materials. 47 years old. Good health. Seek sales and technical service position in the South. Reply to Box F3, PLATING, 445 Broad St., Newark 2, N. J.

PLANT MANAGER—Graduate Chemical and Management Engineer, experienced in all phases of plating plant management. Technical control, cost control, production planning and control, pricing and sales. Reply to Box F4, PLATING, 445 Broad St., Newark 2, N. J.

ELECTRO CHEMIST B.S. degree, 36 years of age. Experienced in all phases of metal finishing including control, research, troubleshooting and production. Prefer midwest location but will consider other. Reply to Box F5, PLATING, 445 Broad St., Newark 2, N. J.

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BUFFING COMPOUND CHEMIST—Leading Midwestern manufacturer of Buffing Compounds and Plating Equipment has opening for man with experience in development and production of all types of buffing compounds, bar, liquid, and greaseless. Some knowledge of plating techniques and equipment also required. To be in charge of production, quality control and research. Prefer age 30–35. Send complete resume. Salary $8,000 to start. All inquiries kept confidential. Reply to Box F6, PLATING, 445 Broad St., Newark 2, N. J.

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CHEMIST for Plating Laboratory in large finishing Company, Newark, New Jersey. Experience in analysis and control. Reply submitting full resume of experience to Box F7, PLATING, 445 Broad St., Newark 2, N. J.

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FUTURE MEETINGS

AMERICAN ELECTROPLATERS' SOCIETY

February 13–14, 1959—**Dixie Regional Group,** Golden Jubilee Educational Session and Banquet, Southeastern Host Branch, Dinkler Plaza Hotel, Atlanta, Ga.

February 13–15, 1959—**Executive Board,** Dinkler Plaza Hotel, Atlanta, Ga.

February 14, 1959—**Sixth Interim Meeting,** Dixie Regional Group Sponsor, Southeastern Host Branch, Dinkler Plaza Hotel, Atlanta, Ga.

March 7, 1959—**Rockford Branch,** Annual Educational Session and Banquet, Faust Hotel, Rockford, Ill.

March 7, 1959—**Dayton Branch,** 13th Annual Meeting and Dinner-Dance, Dayton, Ohio.

March 20, 1959—**Editorial Board,** National Headquarters, Newark, N. J.

March 21, 1959—**Los Angeles Branch,** Annual Educational Session and Banquet, Beverly-Hilton Hotel, Los Angeles, Calif.

April 4, 1959—**Fifth Tri-State Regional,** Louisville Host Branch, Louisville, Ky.

April 11, 1959—**Baltimore-Washington Branch,** Golden Jubilee Banquet and Dance, and "Order of Past Presidents" Award Ceremony, Washington, D. C

April 11, 1959—**Empire State Regional,** Buffalo Host Branch, Hotel Peter Stuyvesant, Buffalo, N. Y.

April 18, 1959—**Twentieth New England Regional,** Waterbury Host Branch, Hotel Statler. Hartford, Conn.

April 25, 1959—**Milwaukee Branch,** Annual Meeting and Banquet, Schroeder Hotel, Milwaukee, Wis.

May 2, 1959—**Boston Branch,** 23rd Annual Technical Session and Banquet, Hotel Statler, Boston, Mass.

June 15–19, 1959—**Golden Jubilee Convention and International Exposition, Including Fifth International Conference on Electrodeposition and Metal Finishing,** Convention Headquarters—Hotels Statler Hilton and Sheraton-Cadillac, Exposition—Artillery Armory, Detroit, Mich.

January 15–16, 1960—**2nd Annual Dixie Regional Technical Session,** Saxony Hotel, Miami Beach, Florida. Sponsored by Miami Branch with Blue Ridge and Southeastern participating.

July 10–14, 1960—**47th AES Annual Convention,** Hotel Statler, Los Angeles, Calif.

June 18–23, 1961—**48th AES Annual Convention,** Hotel Statler, Boston, Mass.

(Continued on page 200)

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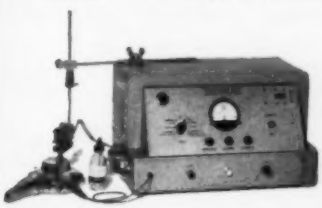

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FUTURE MEETINGS

June 25–28, **1962—49th AES Annual Convention,** Schroeder Hotel, Milwaukee, Wis. Sponsorship Midwest Regional Council.

June 24–27, **1963—50th AES Annual Convention,** Ambassador Hotel, Atlantic City, N. J. Sponsorship Newark Branch.

INTERSOCIETY

March 5, **1959—National Assn. of Metal Finishers,** Board of Directors Meeting, Hotel Statler, St. Louis, Missouri.

March 5, **1959—St. Louis Platers' Assn.,** Membership Rally, Hotel Statler, St. Louis, Mo.

March 16–20, **1959—11th Western Metal Exposition and Congress,** American Society for Metals and other technical groups, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles, Calif.

March 17–19, **1959—National Association of Corrosion Engineers,** 15th Annual Conference and Exhibition, Hotel Sherman, Chicago, Ill.

May 3–7, **1959—The Electrochemical Society,** Spring Meeting, Sheraton Hotel, Philadelphia, Pa.

May 7, **1959—Society of Plastic Engineers,** Regional Technical Conference. "Plastics and the Metals Industry," Penn-Sheraton Hotel, Pittsburgh, Pa.

May 16, **1959—Masters' Electro-Plating Association of New York,** 41st Annual Banquet, Hotel Plaza, New York.

June 14–16, **1959—National Assn. of Metal Finishers,** Annual Membership Meeting, Hotel Statler-Hilton, Detroit, Michigan.

June 15–16, **1959—National Association of Metal Finishers,** Management Seminar, Hotel Statler-Hilton, Detroit, Michigan.

June 21–26, **1959—American Society for Testing Materials,** 62nd Annual Meeting, Hotel Chalfonte-Haddon Hall, Atlantic City, N. J.

May 18–20, **1959—Instrument Society of America,** 5th National Symposium on Instrumental Methods of Analysis, Shamrock-Hilton Hotel, Houston, Texas.

September 21–25, 1959—Instrument Society of America, 14th Annual Instrument-Automation Conference and Exhibit, International Amphitheater, Chicago, Ill.

October 11–16, **1959—American Society for Testing Materials,** Pacific Area National Meeting (with Exhibit), Sheraton-Palace Hotel, San Francisco, Calif.

October 18–22, **1959—The Electrochemical Society,** Fall Meeting, Deshler-Hilton Hotel, Columbus, Ohio.

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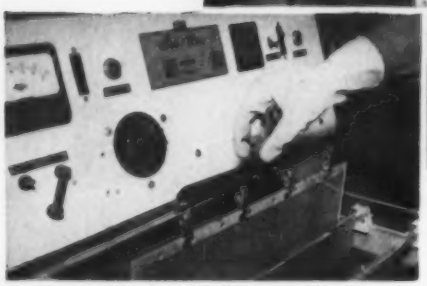

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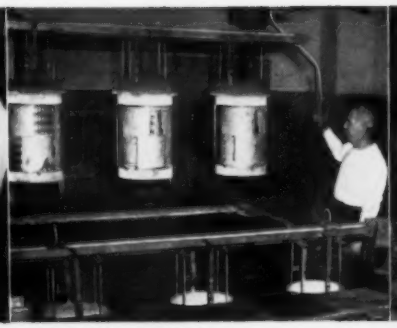

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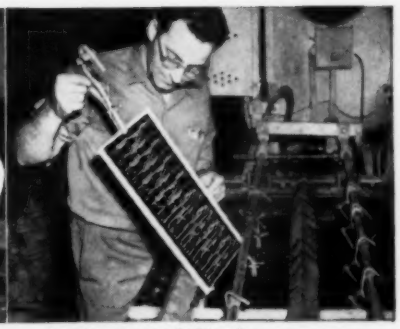

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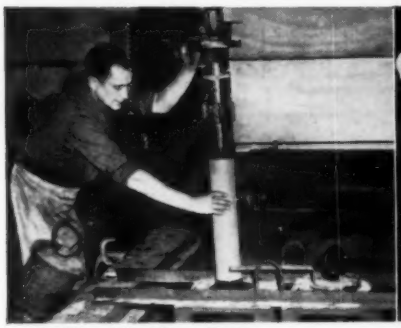

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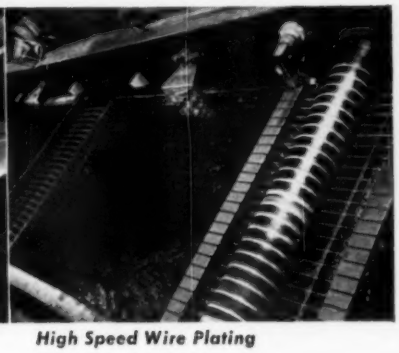

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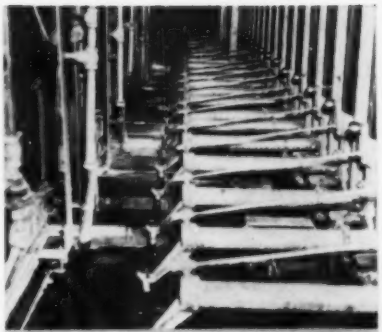

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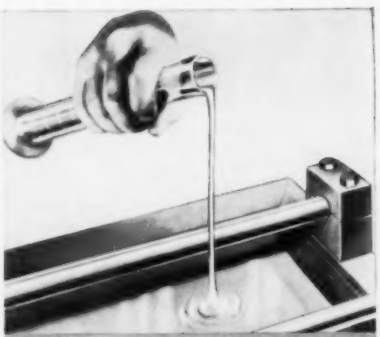

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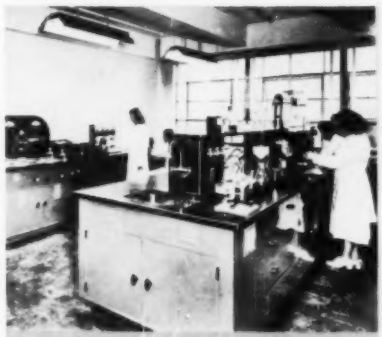

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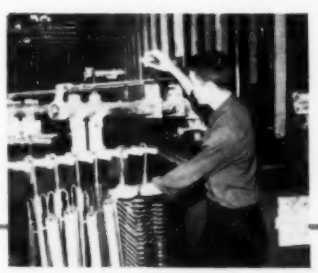

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